CLAIMS

1. An apparatus, comprising:

a substrate having a substrate bond pad;

a sensor over the substrate, the sensor comprising an active surface and a sensor bond pad;

a passivation layer over the active surface of the sensor wherein the passivation layer comprises reaction recesses;

a molding layer over the substrate and covering sides of the sensor, the molding layer having a molding height relative to a top surface of the substrate, the molding height being greater than a height of the active surface of the sensor relative to the top surface of the substrate; and

a lidding layer over the molding layer and over the active surface;

wherein the lidding layer and the molding layer collectively form a space over the active surface of the sensor, the space defining a flow channel.

2. The apparatus of claim 1, further comprising a wire bond connecting the sensor bond pad to the substrate bond pad, wherein the molding layer covers the wire bond.

3. The apparatus of claim 1, further comprising a through-silicon via (TSV) extending through the sensor and electrically connecting the sensor bond pad to a sensor redistribution layer (RDL) on a bottom surface of the sensor, the sensor RDL in electrical contact with the substrate bond pad.

4. The apparatus of claim 1, wherein the molding layer comprises a first molding layer and a second molding layer, the first molding layer comprising a through-mold via (TMV) extending through the first molding layer, the apparatus further comprising a sensor redistribution layer (RDL) connecting the sensor bond pad to the TMV, and wherein the second molding layer is over the RDL and first molding layer.

5. The apparatus of any of claims 1-4, further comprising a functionalized coating over the passivation layer.

6. The apparatus of any of claims 1 - 5, wherein the flow channel encompasses substantially all of the active surface of the sensor.

7. The apparatus of any of claims 1 - 6, wherein the flow channel encompasses the entire active surface of the sensor and at least a portion of an inactive surface of the sensor.

8. The apparatus of any of claims 1 - 7, wherein the flow channel encompasses a horizontal surface of the molding layer.

9. The apparatus of any of claims 1 - 8, wherein the lidding layer comprises an inlet port and an outlet port.

10. The apparatus of claim 9, wherein a surface of the molding layer is between the inlet port and the active surface of the sensor within the flow channel.

11. The apparatus of any of claims 1 - 10, wherein the substrate comprises one or more dielectric layers, each of the one or more dielectric layers comprising one or more conductive pathways therein.

12. The apparatus of any of claims 1 - 11, wherein the sensor comprises a Complementary Metal-Oxide-Semiconductor (CMOS) detection device.

13. The apparatus of any of claims 1 - 12, wherein the apparatus is part of a cartridge to perform biological analysis, chemical analysis, or both.

14. A method, comprising:

placing a sensor over a substrate, the sensor comprising an active surface and a sensor bond pad, wherein the substrate comprises a substrate bond pad;

placing a molding layer over the substrate that covers sides of the sensor;

selectively removing portions of the molding layer directly over the active surface of the sensor; and

placing a lidding layer over the molding layer and over the sensor surface to form a space over the active surface of the sensor, wherein the space defines a flow channel;

said method further comprising

forming a passivation layer on the active sensor surface; and

forming reaction recesses in the passivation layer.

15. The method of Claim 14, further comprising wire bonding the sensor bond pad to the substrate bond pad, wherein the molding layer covers the wire bonds.

16. The method of Claim 14, further comprising forming

a through-silicon via (TSV) extending from the sensor bond pad through the sensor, and

a redistribution layer (RDL) on a bottom surface of the sensor, wherein the sensor bond pad is electrically connected to the RDL.

17. The method of Claim 14, wherein the molding layer is a second molding layer, and the method further comprising forming:

a first molding layer to a height substantially equal to the height of the active surface of the sensor relative to the substrate,

a through-mold via (TMV) through the first molding layer to the substrate bond pad,

redistribution layer (RDL) on a top surface of the sensor to electrically connect the sensor bond pad to the TMV, and

the second molding layer over the RDL and first molding layer.

18. The method of any of claims 14 - 17, further comprising forming an inlet port and an outlet port in the lidding layer.

19 The method of any of claims 14 - 18, further comprising forming a functionalized coating on the passivation layer.

20. An apparatus, comprising:

a sensor over a substrate, the sensor comprising an active surface and a sensor bond pad;

a through-silicon via (TSV) extending through the sensor and electrically connecting the sensor bond pad to a redistribution layer (RDL) over a bottom surface of the sensor, the RDL in electrical contact with the substrate bond pad;

a molding layer over the substrate and covering sides of the sensor, the molding layer having a molding height relative to a top surface of the substrate, the molding height being substantially equal to the height of the active surface of the sensor relative to the top surface of the substrate;

an interposer layer over the molding layer;

a through-silicon via (TSV) in electrical contact with the substrate bond pad, the TSV extending through the substrate;

a passivation layer on the sensor surface and reaction recesses in the passivation layer; and

a lidding layer on the interposer layer and over the active surface;

wherein the lidding layer and the interposer layer collectively form a space over the active surface of the sensor that defines a flow channel.