CLAIMS

1. A device, comprising:

a reaction structure to contain a reaction solution and a plurality of reaction sites that generate light emissions in response to incident excitation light after treatment with the reaction solution, the reaction structure being positioned over a device base;

a plurality of light sensors within the device base;

device circuitry within the device base electrically coupled to the plurality of light sensors to transmit data signals based on photons detected by the light sensors; and

a plurality of light guides with input regions to receive the excitation light and the light emissions from at least one corresponding reaction site, the light guides extending into the device base from the input regions toward at least one corresponding light sensor,

wherein each of the plurality of light guides comprise a first filter region formed of a first filter material to filter the excitation light of at least a first wavelength and permit the light emissions of a second wavelength to pass therethrough to the at least one corresponding light sensor, and a second filter region formed of a second filter material to filter the excitation light of at least the first wavelength and permit the light emissions of a third wavelength to pass therethrough to the at least one corresponding light sensor.

2. The device of claim 1, further comprising a support layer within a bottom portion of the light guides extending below and about a bottom portion of the first filter regions.

3. The device of claim 2, wherein the support layer is comprised of an oxide, a nitride, or a combination thereof.

4. The device of claim 2, wherein the second filter region of the light guides extends over the support layer and about the first filter regions.

5. The device of claim 4, wherein the first and second filter regions form the input regions of the light guides.

6. The device of claim 2, further comprising a liner layer positioned between the support layer and the device circuitry at the bottom portion of the light guides, and positioned between second filter region device circuitry within a top portion of the light guides.

7. The device of claim 6, wherein the liner layer comprises a silicon nitride shield layer.

8. The device of claim 1, wherein the first filter material further filters the light emissions of the third wavelength, and the second filter material further filters the light emissions of the second wavelength.

9. The device of claim 1, wherein the first filter material is a polymer material with a first dye, and the second filter material is a polymer material with a second dye that differs from the first dye.

10. The device of claim 1, wherein each of the plurality of reaction sites is immobilized to the reaction structure within a reaction recess of the reaction structure.

11. The device of claim 10, wherein the reaction solution initiates a reaction and/or forms a reaction product at the reaction sites that generates the light emissions of the second and third wavelengths in response to the incident excitation light.

12. The device of claim 11, wherein the reaction sites comprise at least one analyte, and wherein the reaction solution comprises an aqueous solution containing at least one fluorescently-labeled molecule.

13. The device of claim 12, wherein the at least one analyte comprises an oligonucleotide, and wherein the at least one fluorescently-labeled molecule comprises a fluorescently-labeled nucleotide.

14. The device of claim 1, wherein the device circuitry of the device base forms complementary metal-oxide semiconductor (CMOS) circuits.

15. A biosensor, comprising:

the device of claim 1; and

a flow cell mounted to the device comprising the reaction solution and at least one flow channel that is in fluid communication with the reaction sites of the reaction structure to direct the reaction solution thereto.

16. A method, comprising:

forming a plurality of trenches within a device base comprising a plurality of light sensors and device circuitry electrically coupled to the light sensors to transmit data signals based on photons detected by the light sensors, the plurality of trenches extending from a top surface of the device base and toward at least one corresponding light sensor;

depositing a support layer over inner surfaces of the plurality of trenches;

filling the plurality of trenches over the deposited support layer with a first filter material that filters light of at least a first wavelength and permits light of a second wavelength to pass therethrough to the at least one corresponding light sensor;

removing an upper portion of the deposited support layer within the plurality of trenches positioned between the device base and the first filter material to form a plurality of voids;

filling the plurality of voids with a second filter material that filters light of at least the first wavelength and permits light of a third wavelength to pass therethrough to the at least one corresponding light sensor to form a plurality of light guides; and

forming a reaction structure over the device base and the plurality of light guides for containing a reaction solution and at least one reaction site that generates light of at least one of the second and third wavelengths after treatment with the reaction solution in response to incident excitation light of at least the first wavelength.

17. The method of claim 16, wherein removing the upper portion of the deposited support layer within the plurality of trenches forms a support layer portion that extends below and about a bottom portion of the first regions.

18. The method of claim 16, further comprising depositing a liner layer over the inner surfaces of the plurality of trenches and over the top surface of the device base prior to depositing the support layer such that the support layer extends over the liner layer.

19. The method of claim 16, wherein the first filter material further filters the light of the third wavelength, and the second filter material further filters the light of the second wavelength.

20. The method of claim 16, wherein the first filter material is a polymer material with a first dye, and the second filter material is a polymer material with a second dye that differs from the first dye.