

What is claimed is:

1. An optical detector, comprising:
 - a gas chamber;
 - 5 a light source coupled to the gas chamber and configured to emit an incident light that enters the gas chamber;
 - a sensing object exposed to a gas in the gas chamber, the sensing object having a optical property that depends on a composition of the gas, the sensing object being configured to receive the incident light where the optical property transforms the incident
 - 10 light into a test light;
 - a test optical sensor configured to receive the test light and from the test light, generate a detected spectral signal; and
 - a processor coupled to the test optical sensor, the processor being configured to receive the detected spectral signal and to calculate a detection result according to the
 - 15 detected spectral signal.
2. The optical detector of the claim 1, further comprising:
 - a reference object exposed to the gas, the reference object being configured to receive the incident light and produce a reference light; and
 - 20 a reference optical sensor configured to receive and detect the reference light to obtain a reference spectral signal, wherein
 - the processor is also coupled to the reference optical sensor, the processor being configured to receive the reference spectral signal to calculate the detection result according to the detected spectral signal and the reference spectral signal.
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3. The optical detector of the claim 2, wherein a path length of the incident light reaching the sensing object is the same as a path length of the incident light reaching the reference object, and a path length of the test light reaching the test optical sensor is the same as a path length of the reference light reaching the reference optical sensor.
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4. The optical detector of the claim 2, further comprising protective glass between

the sensing object and the test optical sensor and between the reference object and the reference optical sensor, wherein the protective glass isolates the gas chamber from the test optical sensor and the reference optical sensor.

5 5. The optical detector of the claim 1, wherein the sensing object comprises at least one of a DNA modified phage and a DNA unmodified phage.

6. The optical detector of the claim 1, further comprising a temperature and humidity detector coupled to the processor, the temperature and humidity detector being
10 configured to detect a temperature and a humidity of the gas and to generate a temperature and humidity result, wherein the processor calculates the calibrated result according to the detected spectral signal, the reference spectral signal, and the temperature and humidity result.

15 7. The optical detector of the claim 1, wherein the sensing object contacts the gas and changes color according to a concentration of at least one gas component, so that the sensing object transforms the incident light to form the test light with a spectral distribution corresponding to the concentration of the at least one gas component.

20 8. The optical detector of claim 1, wherein the sensing object comprises a reflective sensing object having a reflective property that depends on a composition of the gas in the gas chamber, the reflective sensing object being configured to receive the incident light and reflect the incident light to form a test light

25 9. The optical detector of claim 1, wherein the sensing object comprises a transmissive sensing object having a transmission characteristic that depends on a composition of the gas in the gas chamber, the transmissive sensing object being configured to receive the incident light and transmit a portion of the incident light to form the test light.

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10. An optical detector comprising:
at least one light source configured to emit an incident light;
a test chamber configured to accommodate a gas to be analyzed and coupled to receive at least a portion of the incident light from the at least one light source;
5 a reflective sensing object exposed to the gas in the test chamber, the reflective sensing object having a reflective property that depends on a composition of the gas, the reflective sensing object being configured to receive the incident light in the test chamber and reflect the incident light to form a test reflected light;
a test optical sensor configured to receive the test reflected light to generate a
10 detected spectral signal; and
a processor coupled to the test optical sensor, the processor being configured to receive the detected spectral signal and calculate a detection result according to the detected spectral signal.

15 11. The optical detector of the claim 10, further comprising:
a reference chamber configured to accommodate the gas to be analyzed and coupled to receive a portion of the incident light from the at least one light source;
a reference object disposed in the reference chamber, the reference object being configured to receive the incident light in the reference chamber and reflect the incident
20 light to form a reference reflected light; and
a reference optical sensor configured to receive and detect the reference reflected light to generate a reference spectral signal,
wherein the processor is further coupled to the reference optical sensor and is configured to receive the detected spectral signal and the reference spectral signal and to
25 calculate a calibrated result according to the detected spectral signal and the reference spectral signal.

12. The optical detector of the claim 11, wherein a path length of the incident light reaching the reflective sensing object is the same as a path length of the incident light
30 reaching the reference object, and a path length of the test reflected light reaching the test optical sensor is the same as a path length of the reference reflected light reaching the

reference optical sensor.

13. The optical detector of the claim 11, further comprising at least one light splitter lens located among the test chamber, the reference chamber and one of at least one light source, each of the at least one light splitter lens being configured to split the incident light from one of the at least one light source to the test chamber and the reference chamber.

14. The optical detector of the claim 11, wherein the reference object is configured to maintain low discoloration under various temperatures and humidity conditions.

15. The optical detector of the claim 14, wherein the reference object comprises ceramic, aluminum oxide, or zirconia.

16. The optical detector of the claim 11, further comprising:
a first protective glass between the test chamber and the test optical sensor, and
a second protective glass between the reference chamber and the reference optical sensor, wherein
the first protective glass and the second protective glass isolate the test optical sensor and the reference optical sensor from the test chamber and the reference chamber.

17. The optical detector of the claim 11, further comprising a temperature and humidity detector coupled to the processor, the temperature and humidity detector being configured to detect a temperature and a humidity of the gas to be analyzed, and to generate a temperature and humidity result, wherein the processor calculates the calibrated result according to the detected spectral signal, the reference spectral signal, and the temperature and humidity result.

18. The optical detector of the claim 10, wherein when the reflective sensing object contacts the gas to be analyzed and changes color according to a concentration of at least one gas component, so that the reflective sensing object reflects the incident light to

form the test reflected light with a spectral distribution corresponding to the concentration of the at least one gas component.

19. The optical detector of the claim 10, wherein the reflective sensing object is an
5 opaque object comprising at least one of a DNA modified phage and a DNA unmodified phage.