

WHAT IS CLAIMED IS:

1. A device for detecting target molecules, comprising:
a surface configured to contact a fluid;
5 a plurality of capture reagents attached to the surface, each capture reagent configured to bind to a target molecule;
a plurality of color centers located proximate the surface; and
at least one detector configured to detect a change in a property of at least one
of the color centers in response to binding the target molecule to one of the capture
10 reagents.
2. The device of claim 1, wherein the target molecule is a protein, and the capture reagents are aptamers.
- 15 3. The device of claim 2, wherein the aptamers are nucleic acid molecules.
4. The device of claim 3, wherein the nucleic acid molecules have at least one 5-position modified pyrimidine.
- 20 5. The device of claim 1, wherein the surface is a surface of a diamond crystal, and the color centers are nitrogen-vacancy centers of the diamond crystal.
6. The device of claim 5, wherein the diamond crystal is a single-crystal diamond.
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7. The device of claim 5, further comprising an optical source configured to irradiate the nitrogen-vacancy centers with radiation having a first range of wavelengths, and wherein the detector is configured to detect radiation having a second range of wavelengths.
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8. The device of claim 5, wherein the property is associated with a magnetic resonance of the nitrogen-vacancy centers.

9. The device of claim 5, further comprising a microwave source configured to provide microwave radiation having a range of frequencies including a resonant frequency of sublevels of an electronic ground state of the nitrogen-vacancy centers.

5 10. The device of claim 1, wherein capture reagents includes reagents belonging to a plurality of capture species, and each capture species is configured to bind to target molecules of a particular target species.

10 11. A device for measuring a concentration of target molecules, comprising:
a crystalline film including at least one color center;
a plurality of capture reagents attached to a surface of the crystalline film and configured to bind to a target molecule; and
a detector assembly configured to irradiate the color center with excitation light and to detect emission of electromagnetic radiation from the color center.

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12. The device of claim 11, wherein the capture reagents include a magnetic spin label, and a magnetic field at the color center changes in response to binding the target molecule to one of the capture reagents.

20 13. The device of claim 12, wherein the detector assembly is configured to irradiate the color center with microwave radiation having a frequency capable of inducing conversion of ground-state electrons in the color center from a first sub-state to a second sub-state.

25 14. The device of claim 11, wherein the crystalline film is a diamond film, and the color center is a nitrogen vacancy center.

30 15. The device of claim 11, wherein binding of one of the capture reagents to one of the target molecules produces a detectable change in the emission of electromagnetic radiation from the color center by changing an interaction between a spin label of the capture reagent and the color center.

16. A device for detecting target molecules, comprising:
a plurality of capture reagents attached to a surface of a crystalline substrate
and configured to capture target molecules from a sample fluid;
a plurality of color centers disposed at fixed distances from the capture
5 reagents, the fixed distances being sufficiently small that a property of at least one of
the color centers changes in response to capture of one of the target molecules by
one of the capture reagents; and
a detector configured to detect a change in the property of at least one of the
color centers.
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17. The device of claim 16, wherein the capture reagents are aptamers.
18. The device of claim 17, wherein the capture reagents are
oligonucleotides.
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19. The device of claim 17, wherein the capture reagents are nucleic acid
molecules having at least one 5-position modified pyrimidine.
20. The device of claim 19, wherein the crystalline substrate is a diamond
20 film, and the color centers are nitrogen vacancy centers.