

According to various embodiments, the chip includes at least 20000 reaction sites. In other embodiments, the chip includes at least 30000 reaction sites.

[009a] In one aspect, there is provided a system for performing biological reactions, the system comprising: a chip including a plurality of reaction sites, wherein the plurality of reaction sites are each configured to include a liquid sample of at most one nanoliter, and wherein the pitch between adjacent reaction sites is from 1 to 125 micrometers; a control system configured to initiate biological reactions in the liquid samples; and a detection system configured to detect biological reactions on the chip.

[009b] In another aspect, there is a method for performing biological reactions, the method comprising: loading a chip including a substrate and a plurality of reaction sites with a liquid sample, wherein the plurality of reaction sites are each configured to include a volume of the liquid sample of at most one nanoliter, and wherein the pitch between adjacent reaction sites is from 1 to 125 micrometers; initiating biological reactions in the plurality of reaction sites; and detecting, with an optical system, a plurality of biological reactions on the chip.

DESCRIPTION OF THE FIGURES

[0010] FIG. 1 illustrates a chip including a plurality of reaction sites according to various embodiments described herein;

[0011] FIG. 2 illustrates a side view of the exemplary chip of FIG. 1 according to various embodiments described herein;

[0012] FIG. 3 illustrates an exemplary method of performing biological reactions according to various embodiments described herein;

[0013] FIG. 4 illustrates an exemplary method of performing biological reactions according to various embodiments described herein;

[0014] FIG. 5 is a block diagram that illustrates a polymerase chain reaction (PCR) instrument, upon which embodiments of the present teachings may be implemented;

[0015] FIG. 6 illustrates an exemplary optics system that can be used to image the chip according to embodiments of the present teachings;

[0016] FIG. 7 illustrates a cut away view of an array in a substrate according to various embodiments described herein;

[0017] FIG. 8 illustrates a cross-sectional view of a chip according to various embodiments described herein;

[0018] FIG. 9 illustrates a hydrophobic surface and through-holes according to various embodiments described herein;

[0019] FIG. 10 illustrates various pitch distances according to various embodiments described herein;

CLAIMS

What is claimed is:

1. A system for performing biological reactions, the system comprising:
a chip including a plurality of reaction sites, wherein the plurality of reaction sites are each configured to include a liquid sample of at most one nanoliter, and wherein the pitch between adjacent reaction sites is from 1 to 125 micrometers;
a control system configured to initiate biological reactions in the liquid samples; and
a detection system configured to detect biological reactions on the chip.
2. The system of claim 1, wherein the chip includes at least 20000 reaction sites.
3. The system of claim 1, wherein the chip includes at least 30000 reaction sites.
4. The system of claim 1, wherein each reaction site of the plurality of reaction sites is a through-hole.
5. The system of claim 1, wherein each reaction site of the plurality of reaction sites is a well.
6. The system of claim 1, wherein the control system is configured to perform polymerase chain reaction (PCR).
7. The system of claim 6, wherein the control system is configured to perform digital PCR.
8. The system of claim 1, wherein the detection system includes an optical system, wherein the optical system includes an excitation source and an optical sensor configured to detect fluorescent signals emitted from a plurality of liquid samples within the plurality of reaction sites.
9. The system of claim 1, wherein a surface of the reaction sites are hydrophilic.
10. The system of claim 9, wherein a surface of the ~~substrate~~ chip is hydrophilic.
11. The system of claim 1, wherein the chip is enclosed in a carrier.

25. The system of claim 23, wherein the surface of the reaction site and the surface of the substrate are coated by vapor deposition.

26. The system of claim 23, wherein the liquid sample has a contact angle of 70-100 degrees with the material.

27. The system of claim 23, wherein the liquid sample is loaded to the reaction sites by capillary action.

28. A method for performing biological reactions, the method comprising:
loading a chip including a substrate and a plurality of reaction sites with a liquid sample, wherein the plurality of reaction sites are each configured to include a volume of the liquid sample of at most one nanoliter, and wherein the pitch between adjacent reaction sites is from 1 to 125 micrometers;

initiating biological reactions in the plurality of reaction sites ; and
detecting, with an optical system, a plurality of biological reactions on the chip.

29. The method of claim 28, wherein the chip includes at least 20000 reaction sites.

30. The method of claim 28, wherein the chip includes at least 30000 reaction sites.

31. The method of claim 28, wherein each reaction site of the plurality of reaction sites is a through-hole.

32. The method of claim 28, wherein each reaction site of the plurality of reaction sites is a well.