

What is claimed is:

1. A flowcell comprising:
a nanowell layer having a first set of nanowells and a second set of nanowells to receive a sample;
a first linear waveguide associated with the first set of nanowells, and a second linear waveguide associated with the second set of nanowells; and
a first grating for the first linear waveguide, and a second grating for the second linear waveguide, the first and second gratings providing differential coupling of first light and second light.
2. The flowcell of claim 1, wherein the first and second gratings are spatially offset from each other.
3. The flowcell of claim 2, wherein the first and second linear waveguides are positioned adjacent to each other, the flowcell further comprising:
a third linear waveguide positioned adjacent to the second linear waveguide opposite from the first linear waveguide.
4. The flowcell of claim 3, wherein the third linear waveguide shares the first grating with the first linear waveguide.
5. The flowcell of claim 3, further comprising a third grating for the third linear waveguide.
6. The flowcell of claim 5, wherein the third grating has the same spatial offset from the second grating as has the first grating.
7. The flowcell of claim 5, wherein the third grating is spatially offset from each of the first and second gratings.
8. The flowcell of any of claims 1-7, wherein the first grating is positioned toward a first end of the first linear waveguide, wherein the second grating is positioned toward a second end of the second linear waveguide, and wherein the first end is positioned opposite from the second end.
9. The flowcell of any of claims 1-8, wherein the first grating is positioned on a triangular substrate.
10. The flowcell of any of claims 1-2 and 8-9, wherein the first and second gratings have different grating periods from each other.

11. The flowcell of claim 10, wherein the first and second linear waveguides are positioned adjacent each other, the flowcell further comprising:

a third linear waveguide positioned adjacent to the second linear waveguide opposite from the first linear waveguide; and

a third grating for the third linear waveguide.

12. The flowcell of claim 11, wherein the third grating has the same grating period as the first grating.

13. The flowcell of claim 11, wherein the third grating has a grating period different from each of the grating periods of the first and second gratings.

14. The flowcell of any of claims 1-13, wherein the nanowells in at least one of the first and second sets of nanowells have a spacing from each other that is resolvable according to a resolution distance of emission optics for the flowcell.

15. The flowcell of claim 14, wherein the first and second linear waveguides are positioned closer to each other than the resolution distance of the emission optics.

16. The flowcell of any of claims 1-15, wherein the differential coupling of the first light comprises coupling the first light into the first linear waveguide and minimizing coupling of the first light into the second linear waveguide.

17. The flowcell of claim 16, wherein the differential coupling of the second light comprises coupling the second light into the second linear waveguide and minimizing coupling of the second light into the first linear waveguide.

18. The flowcell of any of claims 1-17, wherein the differential coupling is at least in part due to a coupler parameter of one or more of the first grating or the second grating.

19. The flowcell of claim 18, wherein the coupler parameter comprises at least one selected from the group consisting of: a refractive index, a pitch, a groove width, a groove height, a groove spacing, a grating non-uniformity, a groove orientation, a groove curvature, a coupler shape, and combinations thereof.

20. The flowcell of any of claims 1-19, wherein the differential coupling is at least in part due to a waveguide parameter of one or more of the first linear waveguide or the second linear waveguide.

21. The flowcell of claim 20, wherein the waveguide parameter comprises at least one selected from the group consisting of: a cross sectional profile, a refractive index difference, a

mode matching, and combinations thereof.

22. The flowcell of any of claims 1-21, wherein the first and second sets of nanowells are arranged in a polygonal array.

23. The flowcell of claim 22, wherein the polygonal array comprises a rectangular array or a hexagonal array.

24. The flowcell of claim 23, wherein the first and second sets of nanowells are arranged in the hexagonal array, which forms at least one hexagon, the hexagon including:

first and second nanowells of the first set of nanowells, the first and second nanowells being part of a first row of nanowells that extends along the first linear waveguide;

third, fourth and fifth nanowells of the second set of nanowells, the third, fourth and fifth nanowells being part of a second row of nanowells that extends along the second linear waveguide; and

sixth and seventh nanowells of a third set of nanowells, the sixth and seventh nanowells being part of a third row of nanowells that extends along a third linear waveguide.

25. The flowcell of any of claims 1-23, wherein the first set of nanowells comprises a first row of nanowells, and wherein the second set of nanowells comprises a second row of nanowells.

26. The flowcell of claim 25, wherein each of the first and second rows of nanowells is aligned with at least one of the first and second linear waveguides.

27. The flowcell of claim 26, wherein the first row of nanowells extends along the first linear waveguide, wherein the second row of nanowells extends along the second linear waveguide, wherein the first linear waveguide is parallel and adjacent to the second linear waveguide, and wherein the first row of nanowells is in phase with the second row of nanowells, the flowcell further comprising:

a third linear waveguide that is parallel and adjacent to the second linear waveguide; and
a third row of nanowells extending along the third linear waveguide, wherein the third row of nanowells is out of phase with the first and second rows of nanowells.

28. The flowcell of claim 27, further comprising:

a fourth linear waveguide that is parallel and adjacent to the third linear waveguide; and
a fourth row of nanowells extending along the fourth linear waveguide, wherein the fourth row of nanowells is in phase with the third row of nanowells.

29. The flowcell of any of claims 1-22, wherein the first and second linear waveguides are parallel and adjacent each other, wherein the first set of nanowells comprises first and second rows of nanowells extending along the first linear waveguide on opposite sides thereof, and wherein the second set of nanowells comprises third and fourth rows of nanowells extending along the second linear waveguide on opposite sides thereof.

30. The flowcell of any of claims 1-29, wherein at least one nanowell of the first and second sets of nanowells has a non-circular opening.

31. The flowcell of claim 30, wherein the non-circular opening comprises an elliptical opening.

32. The flowcell of any of claims 1-31, further comprising structure between the first and second linear waveguides to reduce cross-coupling.

33. The flowcell of claim 32, wherein the structure comprises a series of blocks.

34. The flowcell of claim 32, wherein the structure provides refractive indices that alternate along the structure.

35. The flowcell of any of claims 1-34, wherein the first linear waveguide and the first grating are positioned in a first layer of the flowcell, wherein the second linear waveguide and the second grating are positioned in a second layer of the flowcell, wherein the first and second sets of nanowells are positioned in a third layer of the flowcell, and wherein the second layer is positioned further from the third layer than is the first layer.

36. A method comprising:

applying, at a flowcell, a sample to a first set of nanowells and to a second set of nanowells;

differentially coupling, using a first grating, first light into at least a first linear waveguide associated with the first set of nanowells; and

differentially coupling, using a second grating, second light into at least a second linear waveguide associated with the second set of nanowells.

37. The method of claim 36, wherein the first and second gratings are spatially offset from each other, the method further comprising controlling an illumination component regarding at least one of the first light or the second light.

38. The method of claim 37, wherein controlling the illumination component comprises controlling a beam parameter of a light beam generating at least one of the first light

or the second light.

39. The method of claim 38, wherein controlling the beam parameter comprises at least one selected from the group consisting of: controlling a location of the light beam, controlling an angle of incidence of the light beam, controlling a divergence of the light beam, controlling a mode profile of the light beam, controlling a polarization of the light beam, controlling an aspect ratio of the light beam, controlling a diameter of the light beam, controlling a wavelength of the light beam, and combinations thereof.

40. The method of any of claims 36-39, wherein the first light is being differentially coupled during a first scan performed across the flowcell in a first scan direction, and the second light is being differentially coupled during a second scan performed across the flowcell in a second scan direction opposite to the first scan direction.

41. The method of claim 36, wherein the first and second gratings have different grating periods from each other, the method further comprising arranging an illumination component so that the first light is differentially coupled, and arranging the illumination component so that the second light is differentially coupled.

42. The method of claim 41, wherein the first and second linear waveguides are positioned adjacent each other, and wherein the flowcell further comprises a third linear waveguide positioned adjacent to the second linear waveguide opposite from the first linear waveguide.

43. The method of claim 42, wherein the flowcell further comprises a third grating for the third linear waveguide.

44. The method of claim 43, further comprising differentially coupling the first light also into the third linear waveguide using the third grating.

45. The method of claim 43, further comprising differentially coupling third light into at least the third linear waveguide using the third grating.

46. The method of claim 42, wherein the third linear waveguide shares the first grating with the first linear waveguide.

47. The method of any of claims 36-46, wherein the nanowells in at least one of the first and second sets of nanowells have a spacing from each other that is resolvable according to a resolution distance of emission optics for the flowcell.

48. The method of claim 47, wherein the first and second linear waveguides are

positioned closer to each other than the resolution distance of the emission optics.

49. The method of any of claims 36-48, wherein differentially coupling the first light comprises coupling the first light into the first linear waveguide and minimizing coupling of the first light into the second linear waveguide.

50. The method of claim 49, wherein differentially coupling the second light comprises coupling the second light into the second linear waveguide and minimizing coupling of the second light into the first linear waveguide.