CLAIMS

1. A method for patterning flow cell substrates, comprising:

preparing a flow cell for a photoinitiated chemical reaction, wherein the flow cell includes a substrate having light coupling gratings formed thereon;

a first layer of material disposed over the substrate;

a second layer of material disposed over the first layer of material; and nanowells formed in the second layer of material, wherein each nanowell includes a top portion and a bottom portion, and wherein preparing the flow cell includes:

silanizing the second layer of material;

coating the silanized second layer of material and

nanowells with a first group of reactants;

introducing a second group of reactants into the nanowells, wherein the second group of reactants includes at least one target reactant, a copper chelated ligand, and a light-sensitive photoinitiator system; and

directing light internally within the flow cell through the light coupling gratings to only the bottom portion of each nanowell for photo-initiating a chemical reaction between the first and second groups of reactants,

wherein the photo-initiated chemical reaction covalently binds the target reactant to only the bottom portion of each nanowell,

wherein the method is absent of a polishing step to remove any existing surface chemistry found in interstitial areas between the nano wells.

2. The method of claim 1, further comprising washing unreacted reactants out of the nanowells.

3. The method of claim 2, further comprising using a polymer and azide moieties that are bound to the polymer as the first group of reactants.

4. The method of claim 3, further comprising using poly(N-(5-azidoacetamidylpentyl) acrylamide as the polymer.

5. The method of claim 4, further comprising using a camphorquinone-amine photosensitizing system using a light wavelength of about 470 nm as the light-sensitive photoinitiator system.

6. The method of claim 5, further comprising using an alkyne-linked primer as the target reactant.

7. The method of claim 6, further comprising using an alkyne-linked fluorophore as the target reactant.

8. The method of claim 7, further comprising using a laser as a source of light.

9. The method of claim 8, further comprising using a material having a refractive index in the range of 1.0 to 1.3 for the substrate and a material having a refractive index in the range of 2.0 to 2.15 for the first layer.

10. A method for patterning flow cell substrates, comprising:

fabricating a planar waveguide flow cell, wherein fabricating the planar waveguide flow cell includes:

forming a layer of light coupling gratings on a glass substrate layer;

depositing a core layer on the layer of light coupling gratings;

depositing a cladding layer on the core layer; and

forming nanowell substrates in the cladding layer, wherein each nanowell substrate includes a top portion and a bottom portion, and wherein the nanowell substrates define interstitial regions therebetween;

silanizing the cladding layer;

coating the silanized cladding layer and nanowell substrates with a first group of reactants;

introducing a second group of reactants into the nanowell substrates, wherein the second group of reactants includes at least one target reactant, a copper chelated ligand, and a light-sensitive photoinitiator system; and

directing light internally within the planar waveguide flow cell through the light coupling gratings to only the bottom portion of each nanowell substrate for photo-initiating a chemical reaction between the first and second groups of reactants,

wherein the photo-initiated chemical reaction covalently binds the target reactant to only the bottom portion of each nanowell substrate,

wherein the method is absent of a polishing step to remove any existing surface chemistry found in interstitial areas between the nano wells.

11. The method of claim 10, further comprising washing unreacted reactants out of the nanowell substrates.

12. The method of claim 11, further comprising using a polymer and azide moieties that are bound to the polymer as the first group of reactants.

13. The method of claim 12, further comprising using poly(N-(5-azidoacetamidylpentyl) acrylamide as the polymer.

14. The method of claim 13, further comprising using a camphorquinone-amine photosensitizing system using a light wavelength of about 470 nm as the light-sensitive photoinitiator system.

15. The method of claim 14, further comprising using an alkyne-linked primer as the target reactant.

16. The method of claim 15, further comprising using an alkyne-linked fluorophore as the target reactant.

17. The method of claim 16, further comprising using a laser as a source of light.

18. The method of claim 17, further comprising using a material having a refractive index in the range of 1.0 to 1.3 for the layer of light coupling gratings and a material having a refractive index in the range of 2.0 to 2.15 for the core layer.

19. A method for patterning flow cell substrates, comprising:

fabricating a planar waveguide flow cell, wherein fabricating the planar waveguide flow cell includes:

forming a layer of light coupling gratings on a glass substrate layer;

depositing a core layer on the layer of light coupling gratings;

depositing a cladding layer on the core layer; and

forming nanowell substrates in the cladding layer, wherein each nanowell substrate includes a top portion and a bottom portion, and wherein the nanowell substrates define interstitial regions therebetween; and

silanizing the cladding layer;

coating the cladding layer and nanowell substrates with a first group of reactants, wherein the first group of reactants further includes a polymer, azide moieties bound to the polymer, a copper ligand, and a light-sensitive photoinitiator system;

directing light of a predetermined wavelength internally within the planar waveguide flow cell to only the bottom portion of each nanowell substrate for photo-initiating a chemical reaction between the reactants in the first group of reactants, wherein the photo-initiated chemical reaction covalently binds the polymer to only the bottom portion of each nanowell substrate;

introducing a second group of reactants into the nanowell substrates, wherein the second group of reactants includes at least one target reactant, a copper ligand and a light-sensitive photoinitiator system; and

directing light of a predetermined wavelength internally within the planar waveguide flow cell to only the bottom portion of each nanowell substrate for photo-initiating a chemical reaction between the covalently bound polymer and the second group of reactants, wherein the photo-initiated chemical reaction covalently binds the target reactant to only the bottom portion of each nanowell substrate,

wherein the method is absent of a polishing step to remove any existing surface chemistry found in interstitial areas between the nano wells.

20. The method of claim 19, further comprising washing unreacted reactants out of the nanowell substrates after each photo-initiated chemical reaction.

21. A flow cell for a photoinitiated chemical reaction, which flow cell comprises:

a substrate,

a light coupling grating layer arranged on the substrate, which light coupling grating layer has a refractive index,

a core layer arranged on the grating layer, which core layer has a refractive index, wherein the refractive index of the core layer is greater than the refractive index of the light coupling grating layer,

a silanized layer arranged on the core layer in which silanized layer multiple nanowells are present, and

wherein the nanowells are separated by interstitial areas.

22. A method of sequencing nucleic acids, using a flow cell made by any of the previous claims 1-20 and/or a flow cell according to claim 21.

23. A system for photoinitiated chemical reactions comprising a flow cell according to claim 21 and a light source, preferably a laser light source.