

What is claimed is:

1. A kit, comprising:
a flow cell, including:
a substrate;
5 a catalytic polymeric hydrogel on the substrate, the catalytic polymeric hydrogel including a deblocking catalyst; and
an amplification primer attached to the catalytic polymeric hydrogel;
wherein the catalyst accelerates cleavage of a blocking group of a 3' OH
blocked nucleotide introduced to the flow cell and incorporated into a template
10 strand attached to the amplification primer; and
a cleavage mix including a component to initiate cleavage of the blocking group.
2. The kit as defined in claim 1, wherein the deblocking catalyst is selected
from the group consisting of an acid catalyst, a base catalyst, an enzyme, a peptide, a
15 DNAzyme, an organic catalyst, and combinations thereof.
3. The kit as defined in claim 1, wherein the deblocking catalyst is a metal of a
metal-ligand complex that is attached to the polymeric hydrogel.
- 20 4. The kit as defined in claim 1, wherein the deblocking catalyst is an acid
catalyst selected from the group consisting of a carboxylic acid, a phosphonic acid, a
sulfonic acid, and combinations thereof.
5. The kit as defined in claim 1, wherein the deblocking catalyst is a base
25 catalyst selected from the group consisting of an amine, a heterocyclic amine, and
combinations thereof.
6. The kit as defined in claim 1, wherein the deblocking catalyst is an enzyme.
- 30 7. The kit as defined in claim 1, wherein the deblocking catalyst is a peptide.

8. The kit as defined in claim 1, wherein the deblocking catalyst is a DNAzyme.

9. A method, comprising:

introducing an incorporation mix to a flow cell including:

- 5 a substrate;
- a catalytic polymeric hydrogel on the substrate, the catalytic polymeric hydrogel including a deblocking catalyst; and
- template strands attached to the catalytic polymeric hydrogel;
- thereby incorporating individual nucleotides into respective nascent strands along the
- 10 template strands, the individual nucleotides including:
- a dye label attached to a base; and
- a 3' OH blocking group attached to a sugar;
- removing the incorporation mix;
- optically imaging incorporation of individual nucleotides; and
- 15 introducing a cleavage mix, including a component to initiate cleavage of the 3' OH blocking group, to the flow cell, whereby the deblocking catalyst accelerates cleavage of the 3' OH blocking group.

20 10. The method as defined in claim 9 wherein the catalyst accelerates removal of an outer protecting group of the 3' OH blocking group, and wherein a reagent in the cleavage mix removes an inner protecting group of the 3' OH blocking group.

11. A flow cell, comprising:

- a substrate;
- 25 a catalytic polymeric hydrogel on the substrate, the catalytic polymeric hydrogel including a deblocking catalyst selected from the group consisting of:
- a phosphonic acid;
- a heterocyclic amine;
- an enzyme;
- 30 a peptide;
- a DNAzyme;

a metal of a metal-ligand complex;

an organic catalyst selected from the group consisting of a urea, a thiourea, an imidazole, a guanidine, 1,8-Diazabicyclo(5.4.0)undec-7-ene, and combinations thereof; and

5 a photoacid generator; and

an amplification primer attached to the catalytic polymeric hydrogel.

12. The flow cell as defined in claim 11, wherein the catalyst is integrated into a monomeric unit of the catalytic polymeric hydrogel.

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13. The flow cell as defined in claim 11, wherein the catalyst is grafted to an initial polymeric hydrogel.

14. The flow cell as defined in claim 11 wherein the catalytic polymeric hydrogel includes an initial polymeric hydrogel, and wherein the flow cell further comprises an oligonucleotide attached to the initial polymeric hydrogel, and wherein the deblocking catalyst is attached to a complementary oligonucleotide tether that is hybridized to the oligonucleotide.

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15. A flow cell, comprising:

a substrate;

a polymeric hydrogel on the substrate, the polymeric hydrogel including a first member of a hydrogen bonding pair;

25 a deblocking catalyst attached to the polymeric hydrogel through a second member of the hydrogen bonding pair; and

an amplification primer attached to the catalytic polymeric hydrogel.

16. A method, comprising:

applying a catalytic polymeric hydrogel to a surface of a flow cell substrate, the catalytic polymeric hydrogel including a deblocking catalyst selected from the group consisting of:

- 5 a phosphonic acid;
- a heterocyclic amine;
- an enzyme;
- a peptide;
- a DNAzyme;
- 10 a metal of a metal-ligand complex;
- an organic catalyst selected from the group consisting of a urea, a thiourea, an imidazole, a guanidine, 1,8-Diazabicyclo(5.4.0)undec-7-ene, and combinations thereof; and
- a photoacid generator; and
- 15 attaching amplification primers to the catalytic polymeric hydrogel.

17. The method as defined in claim 16, further comprising forming the catalytic polymeric hydrogel including the deblocking catalyst.

- 20 18. The method as defined in claim 17, wherein forming the catalytic polymeric hydrogel involves copolymerizing a first monomer including a primer-grafting functional group with a second monomer including the deblocking catalyst.

- 25 19. The method as defined in claim 17, wherein forming the catalytic polymeric hydrogel involves:
 - synthesizing an initial polymeric hydrogel; and
 - grafting the catalyst to the initial polymeric hydrogel.

20. The method as defined in claim 17, wherein forming the catalytic polymeric hydrogel involves:

- synthesizing an initial polymeric hydrogel;
- grafting an oligonucleotide to the initial polymeric hydrogel; and
- 5 hybridizing a complementary oligonucleotide tether to the oligonucleotide, wherein the catalyst is attached to the complementary oligonucleotide tether.

21. The method as defined in claim 17, wherein forming the catalytic polymeric hydrogel involves:

- 10 synthesizing an initial polymeric hydrogel; and
- attaching a metal-ligand complex to the initial polymeric hydrogel, wherein a metal of the metal-ligand complex is the catalyst.