Claims

1. A graft mix, comprising:

a primer comprising an alkyne functional group;

a solvent; and

a copper (I) sulfide mineral,

wherein the alkyne functionalized molecule is bound directly to a surface of the copper (I) sulfide mineral particle by a coordinate bond.

2. The graft mix as defined in claim 1, wherein the alkyne functional group is to react with a surface of the copper (I) sulfide mineral to form a catalytically active substance in the graft mix.

3. The graft mix as defined in claim 1, further comprising an azide functionalized molecule, wherein the azide functionalized molecule is to react with the alkyne functional group, mediated by the copper (I) sulfide mineral.

4. The graft mix as defined in claim 3, wherein the azide functionalized molecule is a polymer.

5. The graft mix as defined in claim 4, wherein the polymer is on a surface of a substrate, optionally wherein the substrate is a flow cell.

6. The graft mix as defined in any one of claims 1 to 5, wherein the graft mix comprises a stoichiometric excess of the copper (I) sulfide mineral with respect to the primer.

7. The graft mix as defined in any one of claims 1 to 6, wherein the graft mix comprises:

from 1 μM to 20 μM of the primer; and

from 0.1 M to 3 M of the copper (I) sulfide mineral.

8. The graft mix as defined in any one of claims 1 to 7, wherein the copper (I) sulfide mineral is selected from the group consisting of chalcocite, djurleite, and digenite, and has an average particle size ranging from 500 nm to 45 μm.

9. A method of grafting a primer to a flow cell surface, comprising:

reacting an alkyne functionalized primer in the presence of a copper (I) sulfide mineral with an azide functionalized molecule on the flow cell surface,

wherein the alkyne functionalized molecule is bound directly to a surface of the copper (I) sulfide mineral particle by a coordinate bond.

10. The method as defined in claim 9, wherein:

the copper (I) sulfide mineral reacts with the alkyne functionalized primer to form a catalytically active substance; and

the catalytically active substance reacts with the azide functionalized molecule to couple the catalytically active substance with the azide functionalized molecule on the flow cell surface.

11. The method as defined in claim 10, wherein prior to reacting the copper (I) sulfide mineral with the alkyne functionalized primer, the method further comprises adding a stoichiometric excess of the copper (I) sulfide mineral, with respect to the alkyne functionalized primer, to the alkyne functionalized primer.

12. The method as defined in claim 10, wherein the reacting of the copper (I) sulfide mineral with the alkyne functionalized primer involves:

forming a mixture of the copper (I) sulfide mineral, the alkyne functionalized primer, and a solvent of the alkyne functionalized primer; and

maintaining the mixture at a temperature that is above a freezing point of the solvent and below a boiling point of the solvent for a time up to 50 days.

13. The method as defined in claim 12, wherein:

the solvent is selected from the group consisting of water, a sodium carbonate buffer, a potassium phosphate buffer, and dimethyl sulfoxide; and

a pH of the mixture ranges from 4 to 12.

14. The method as defined in claim 12 or 13, wherein the maintaining involves heating the mixture to a temperature ranging from 30°C to 60°C for a time ranging from 30 minutes to 90 minutes.

15. The method as defined in claim 10, wherein prior to reacting the catalytically active substance with the azide functionalized molecule on the flow cell surface, the method further comprises forming a layer of the azide functionalized molecule on the flow cell surface, and wherein the catalytically active substance is reacted with the layer of the azide functionalized molecule on the flow cell surface.

16. The method as defined in claim 15, wherein the catalytically active substance is present in a liquid mixture, and wherein the liquid mixture is flowed over the layer of the azide functionalized molecule on the flow cell surface.

17. The method as defined in claim 15 or 16, wherein prior to forming the layer, the method further comprises attaching a silane or a silane derivative to the flow cell surface to form a silanized surface.

18. The method as defined in any one of claims 15 to 17, wherein the layer of the azide functionalized molecule is poly(N-(5-azidoacetamidylpentyl) acrylamide-co-acrylamide).

19. The method as defined in any one of claims 9 to 18, further comprising filtering unreacted copper (I) sulfide mineral from the catalytically active substance prior to reacting the catalytically active substance with the azide functionalized molecule on the flow cell surface.