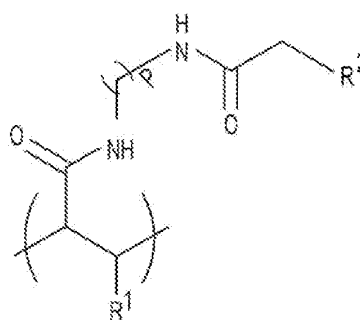


What is claimed is:

1. A flow cell, comprising:
a substrate; and
a copolymer coating attached to at least a portion of the substrate, the
- 5 copolymer coating including a plurality of copolymer chains, wherein each copolymer chain includes:



a first recurring unit of formula (I):

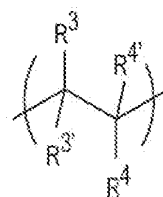
wherein:

- 10 R^1 is selected from the group consisting of -H, a halogen, an alkyl, an alkoxy, an alkenyl, an alkynyl, a cycloalkyl, an aryl, a heteroaryl, a heterocycle, and optionally substituted variants thereof;

R^2 is an azido;

each $(CH_2)_p$ can be optionally substituted; and

p is an integer from 1 to 50;



- 15 a second recurring unit of formula (II):

each of R^3 , R^3' , R^4 , R^4' is independently selected from the group consisting of -H, R^5 , $-OR^5$, $-C(O)OR^5$, $-C(O)R^5$, $-OC(O)R^5$, $-C(O)NR^6R^7$, and $-NR^6R^7$;

- 20 R^5 is selected from the group consisting of -H, -OH, an alkyl, a cycloalkyl, a hydroxyalkyl, an aryl, a heteroaryl, a heterocycle, and optionally substituted variants thereof; and

each of R^6 and R^7 is independently selected from the group
consisting of $-H$ and an alkyl;
and wherein at least some of the copolymer chains include at least one
alkoxyamine end group.

5

2. The flow cell as defined in claim 1 wherein the substrate includes a base
support and a plurality of norbornene silane molecules attached to the base support.

3. The flow cell as defined in claim 2, wherein at least one of the plurality of
norbornene silane molecules attaches to a respective copolymer chain through the at
least one alkoxyamine end group.

4. The flow cell as defined in claim 1, wherein R^2 of some of the copolymer
chains is replaced with tetramethylethylenediamine.

15

5. The flow cell as defined in claim 4, wherein the copolymer coating includes
some branched copolymer chains.

6. The flow cell as defined in claim 1, wherein:
each of R^3 , R^4 , and R^4 is $-H$;
 R^3 is $-C(O)NR^6R^7$; and
each of R^6 and R^7 is $-H$.

20

7. The flow cell as defined in claim 6, wherein:
 R^1 is $-H$; and
 p is 5.

25

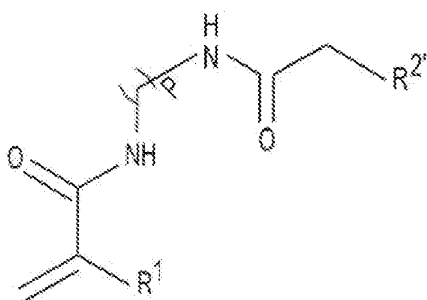
8. The flow cell as defined in claim 1, wherein:
the substrate includes depressions separated by interstitial regions; and
the copolymer coating is attached within the depressions.

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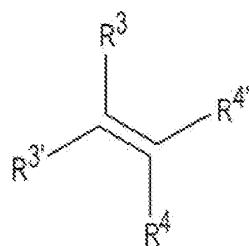
9. The flow cell as defined in claim 1, wherein:
the copolymer coating forms isolated pads on a surface of the substrate; and
interstitial regions separate the isolated pads.

- 5 10. The flow cell as defined in claim 1, wherein:
the first recurring unit and the second recurring unit form a random copolymer;
or
the first recurring unit and the second recurring unit form a statistical copolymer;
or
10 the first recurring unit and the second recurring unit form a block copolymer.

11. A method, comprising:
copolymerizing a reaction mixture of monomers of formula (III):



, and monomers of formula (IV):



15 , wherein:

for formula (III):

R¹ is selected from the group consisting of -H, a halogen, an alkyl,
an alkoxy, an alkenyl, an alkynyl, a cycloalkyl, an aryl, a heteroaryl, a
heterocycle, and optionally substituted variants thereof;

20 R² is an azido or a halogen;

each $(CH_2)_p$ can be optionally substituted; and

p is an integer from 1 to 50; and

for formula (IV):

5 each of R^3 , R^3 , R^4 , R^4 is independently selected from the group consisting of -H, R^5 , $-OR^5$, $-C(O)OR^5$, $-C(O)R^5$, $-OC(O)R^5$, $-C(O)NR^6R^7$, and $-NR^6R^7$;

R^5 is selected from the group consisting of -H, -OH, an alkyl, a cycloalkyl, a hydroxyalkyl, an aryl, a heteroaryl, a heterocycle, and optionally substituted variants thereof; and

10 each of R^6 and R^7 is independently selected from the group consisting of -H and an alkyl;

adding i) a nitroxide mediated polymerization unimolecular initiator or ii) a combination of a water soluble initiator and a nitroxide to the reaction mixture to initiate the copolymerization, thereby generating a product mixture with copolymer chains, 15 whereby at least some of the copolymer chains have an alkoxyamine end group;

depositing the product mixture on a substrate having surface bound norbornene silane molecules; and

allowing at least some of the alkoxyamine end groups to react with at least some of the surface bound norbornene silane molecules, thereby forming a copolymer 20 coating.

12. The method as defined in claim 11, wherein:

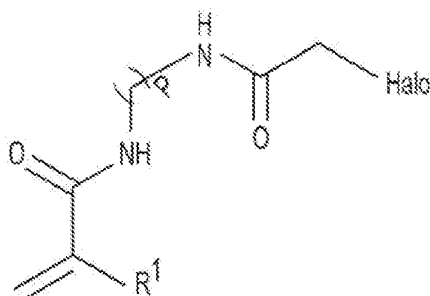
$R^{2'}$ is the azido; and

the method further comprises curing the copolymer coating, whereby some of 25 the azidos react with some other of the surface bound norbornene silane molecules.

13. The method as defined in claim 11, wherein:

$R^{2'}$ is the azido; and

prior to the copolymerizing, the method further comprises generating the monomer of formula (III) by reacting a monomer of a formula (V):



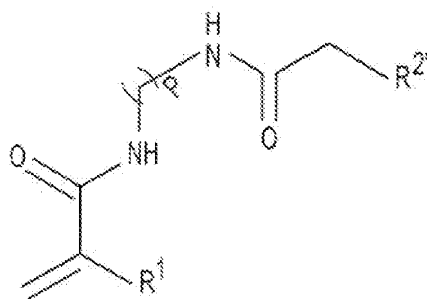
with NaN₃ to introduce the azido.

- 5 14. The method as defined in claim 11, wherein:
 R^{2'} is the halogen; and
 prior to the deposition of the product mixture, the method further comprises:
 introducing NaN₃ to the product mixture; and
 heating the product mixture to replace the halogen with the azido.

10

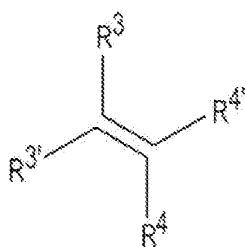
15. The method as defined in claim 11, further comprising adding
 tetramethylethylenediamine to the reaction mixture, and wherein at least some of the
 copolymer chains are branched.

- 15 16. A method, comprising:
 adding i) a nitroxide mediated polymerization unimolecular initiator or ii) a
 combination of a water soluble initiator and a nitroxide to a mixture of a monomer of



formula (III):

, and monomer of formula (IV):



, in the presence of a substrate having surface bound norbornene silane molecules, wherein:

for formula (III):

5 R^1 is selected from the group consisting of -H, a halogen, an alkyl, an alkoxy, an alkenyl, an alkynyl, a cycloalkyl, an aryl, a heteroaryl, a heterocycle, and optionally substituted variants thereof;

$R^{2'}$ is an azido or a halogen;

each $(CH_2)_p$ can be optionally substituted; and

p is an integer from 1 to 50; and

10 for formula (IV):

each of R^3 , $R^{3'}$, R^4 , $R^{4'}$ is independently selected from the group consisting of -H, R^5 , $-OR^5$, $-C(O)OR^5$, $-C(O)R^5$, $-OC(O)R^5$, $-C(O)NR^6R^7$, and $-NR^6R^7$;

15 R^5 is selected from the group consisting of -H, -OH, an alkyl, a cycloalkyl, a hydroxyalkyl, an aryl, a heteroaryl, a heterocycle, and optionally substituted variants thereof; and

each of R^6 and R^7 is independently selected from the group consisting of -H and an alkyl;

20 thereby generating a copolymer coating covalently attached to the norbornene silane molecules.

17. The method as defined in claim 16, wherein:

R^2 is the azido; and

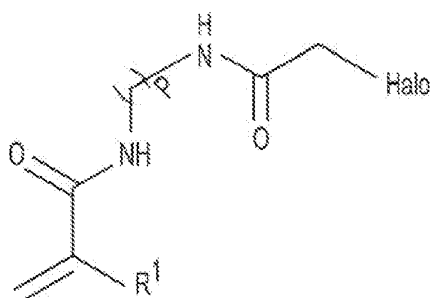
25 the method further comprises curing the copolymer coating on the substrate, whereby some of the azidos react with some other of the surface bound norbornene silane molecules.

18. The method as defined in claim 16, wherein:

R^2 is the azido; and

prior to the copolymerizing, the method further comprises generating the

5 monomer of formula (III) by reacting a monomer of a formula (V):



with NaN₃ to introduce the azido.

19. The method as defined in claim 16, wherein:

R^2 is the halogen; and

10 after the copolymerization, the method further comprises:

introducing NaN₃ to the copolymer coating; and

heating the copolymer coating to replace the halogen with the azido.

20. The method as defined in claim 19, further comprising curing the copolymer

15 coating on the substrate, whereby some of the azidos react with some other of the surface bound norbornene silane molecules.

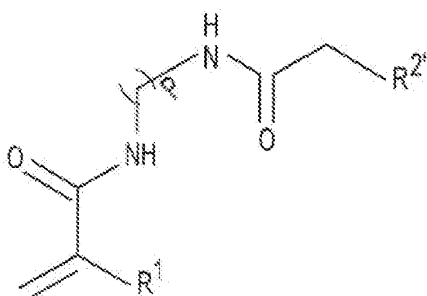
21. The method as defined in claim 16, further comprising adding

tetramethylethylenediamine to the mixture during the copolymerization, and wherein at

20 least some of the copolymer chains are branched.

22. A method, comprising:

copolymerizing a reaction mixture of a monomer of formula (III):



and an other monomer in the presence of i) a nitroxide mediated polymerization unimolecular initiator or ii) a combination of a water soluble initiator and a nitroxide, wherein:

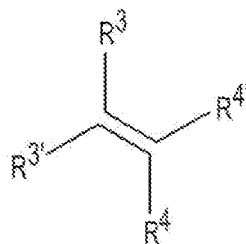
R^1 is selected from the group consisting of -H, a halogen, an alkyl, an alkoxy, an alkenyl, an alkynyl, a cycloalkyl, an aryl, a heteroaryl, a heterocycle, and optionally substituted variants thereof;

$R^{2'}$ is an azido;

each $(CH_2)_p$ can be optionally substituted; and

p is an integer from 1 to 50;

quenching the polymerization, thereby generating a first product mixture with block copolymer chains, whereby at least some of the block copolymer chains have an alkoxyamine end group;



adding monomers of formula (IV): to the first product mixture to generate a second reaction mixture, wherein:

each of R^3 , $R^{3'}$, R^4 , $R^{4'}$ is independently selected from the group consisting of -H, R^5 , $-OR^5$, $-C(O)OR^5$, $-C(O)R^5$, $-OC(O)R^5$, $-C(O)NR^6R^7$, and $-NR^6R^7$;

R^5 is selected from the group consisting of -H, -OH, an alkyl, a cycloalkyl, a hydroxyalkyl, an aryl, a heteroaryl, a heterocycle, and optionally substituted variants thereof; and

each of R^6 and R^7 is independently selected from the group consisting of -H and an alkyl;

5 polymerizing the second reaction mixture in the presence of the i) the nitroxide mediated polymerization unimolecular initiator or ii) the combination of the water soluble initiator and the nitroxide;

10 quenching the polymerization, thereby generating a second product mixture with block copolymer chains, whereby at least some of the block copolymer chains have an alkoxyamine end group;

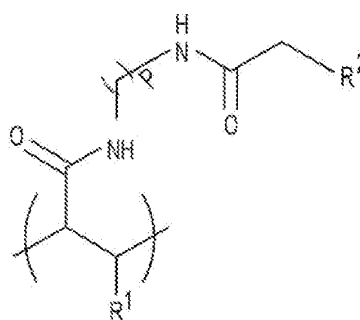
depositing the second product mixture on a substrate having surface bound norbornene silane molecules; and

15 reacting at least some of the alkoxyamine end groups with at least some of the surface bound norbornene silane molecules.

23. A flow cell, comprising:

a substrate; and

20 a copolymer coating attached to at least a portion of the substrate, the copolymer coating including a plurality of copolymer chains, wherein each copolymer chain includes:



a first recurring unit of formula (I):

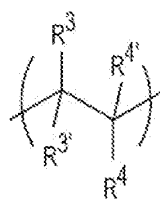
wherein:

R^1 is selected from the group consisting of -H, a halogen, an alkyl, an alkoxy, an alkenyl, an alkynyl, a cycloalkyl, an aryl, a heteroaryl, a heterocycle, and optionally substituted variants thereof;

R^2 is an azido;

5 each $(CH_2)_p$ can be optionally substituted; and

p is an integer from 1 to 50;



a second recurring unit of formula (II): , wherein:

each of R^3 , R^3' , R^4 , R^4' is independently selected from the group consisting of -H, R^5 , -OR⁵, -C(O)OR⁵, -C(O)R⁵, -OC(O)R⁵, -C(O)NR⁶R⁷, and -NR⁶R⁷;

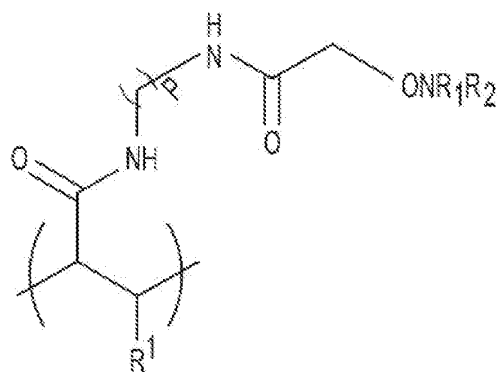
10

R^5 is selected from the group consisting of -H, -OH, an alkyl, a cycloalkyl, a hydroxyalkyl, an aryl, a heteroaryl, a heterocycle, and optionally substituted variants thereof; and

each of R^6 and R^7 is independently selected from the group consisting of -H and an alkyl; and

15

a third recurring unit of formula (VI):



wherein:

R^1 is selected from the group consisting of -H, a halogen, an alkyl, an alkoxy, an alkenyl, an alkynyl, a cycloalkyl, an aryl, a heteroaryl, a heterocycle, and optionally substituted variants thereof;

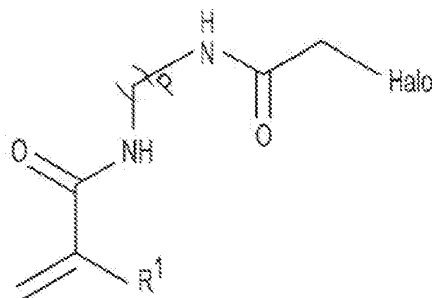
R_1 and R_2 are independently selected from a carbon based substituent;

each $(CH_2)_p$ can be optionally substituted; and
 p is an integer from 1 to 50.

24. The flow cell as defined in claim 23, wherein at least some of the copolymer chains include at least one alkoxyamine end group.

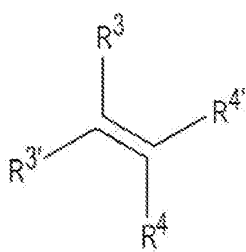
25. A method, comprising:

adding i) a nitroxide mediated polymerization unimolecular initiator or ii) a combination of a water soluble initiator and a nitroxide to a mixture of a monomer of



15 formula (V):

, and monomer of formula (IV):



, wherein:

for formula (V):

R^1 is selected from the group consisting of -H, a halogen, an alkyl, an alkoxy, an alkenyl, an alkynyl, a cycloalkyl, an aryl, a heteroaryl, a heterocycle, and optionally substituted variants thereof;

halo is a halogen;

each $(CH_2)_p$ can be optionally substituted; and

p is an integer from 1 to 50; and

for formula (IV):

5 each of R^3 , R^3 , R^4 , R^4 is independently selected from the group consisting of -H, R^5 , -OR⁵, -C(O)OR⁵, -C(O)R⁵, -OC(O)R⁵, -C(O)NR⁶R⁷, and -NR⁶R⁷;

R^5 is selected from the group consisting of -H, -OH, an alkyl, a cycloalkyl, a hydroxyalkyl, an aryl, a heteroaryl, a heterocycle, and
10 optionally substituted variants thereof; and

each of R^6 and R^7 is independently selected from the group consisting of -H and an alkyl;

thereby generating a copolymer; and

after the copolymerization, converting some of the halogens to alkoxyamines
15 and some other of the halogens to azides.

26. The method as defined in claim 25, wherein converting some of the halogens to alkoxyamines and some other of the halogens to azides involves:

introducing a hydroxylamine to the copolymer so that the halogens are in
20 excess of the hydroxylamine;

heating the copolymer to initiate a reaction where the hydroxylamine displaces some of the halogens;

introducing NaN₃ to the copolymer; and

heating the copolymer to initiate a reaction where the azide displaces some
25 other of the halogens.

27. The method as defined in claim 25, wherein converting some of the halogens to hydroxyamines and some other of the halogens to azides involves:

introducing a mixture of hydroxylamine and NaN₃ to the copolymer; and

30 heating the copolymer to initiate a reactions where the hydroxylamine displaces some of the halogens and where the azide displaces some other of the halogens.

28. The method as defined in claim 25, wherein converting some of the halogens to hydroxyamines and some other of the halogens to azides involves:
- deprotonating a hydroxylamine to form an alkoxyamine anion;
 - 5 introducing the alkoxyamine anion to the copolymer so that the halogens are in excess of the alkoxyamine anion;
 - heating the copolymer to initiate a reaction where the alkoxyamine anion displaces some of the halogens;
 - introducing NaN_3 to the copolymer; and
 - 10 heating the copolymer to initiate a reaction where the azide displaces some other of the halogens.