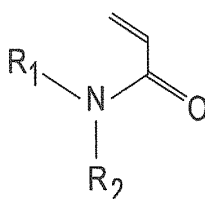
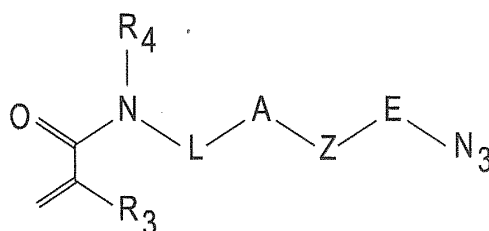


CLAIMS

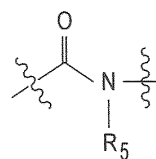
1. A hydrogel, comprising:
 5 a dendritic core having from 2 arms to 30 arms;
 a first acrylamide monomer incorporated into each arm of the dendritic core, the first acrylamide monomer having a structure:

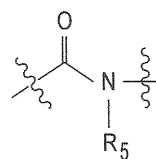


- wherein R_1 and R_2 are independently selected from the group consisting of an alkyl, an alkylamino, an alkylamido, an alkylthio, an aryl, a glycol, and optionally substituted variants thereof; and
 10 a second acrylamide monomer incorporated into each arm of the dendritic core, the second acrylamide monomer having a structure:



- wherein R_3 is hydrogen or an alkyl; R_4 is hydrogen or an alkyl; L is a linker including a linear chain of 2 atoms to 20 atoms wherein each atom is independently selected from the group consisting of carbon, oxygen, and nitrogen and optional substituents on any carbon and any nitrogen atoms in
 15



- the chain; A is an N substituted amide having a structure , where R_5 is hydrogen or an alkyl; E is a linear chain of 1 atom to 4 atoms wherein each atom is independently selected from the group consisting of carbon, oxygen and nitrogen, and optional substituents on any carbon and any nitrogen atoms in the chain; and Z is an optional nitrogen containing heterocycle.
 20

2. The hydrogel as defined in claim 1, wherein the first acrylamide monomer is *N,N*-dimethylacrylamide.

3. The hydrogel as defined in claim 1 or 2, wherein the dendritic core contains a
5 thiocarbonylthio group in each arm.

4. The hydrogel as defined in claim 3, wherein the thiocarbonylthio group is selected from the group consisting of a dithiobenzoate, a trithiocarbonate, and a dithiocarbamate.

10 5. The hydrogel as defined in claim 3, wherein the dendritic core is selected from the group consisting of 3,5-Bis(2-dodecylthiocarbonothioylthio-1-oxopropoxy)benzoic acid, 1,1,1-Tris[(dodecylthiocarbonothioylthio)-2-methylpropionate]ethane, and Pentaerythritol tetrakis[2-(dodecylthiocarbonothioylthio)-2-methylpropionate].

15 6. The hydrogel as defined in any of the preceding claims, wherein the dendritic core includes an atom transfer radical polymerization initiator in each arm.

7. The hydrogel as defined in claim 6, wherein the dendritic core is selected from the group consisting of Bis[2-(2'-bromoisobutyryloxy)ethyl]disulfide, 2-Bromoisobutyric anhydride,
20 Ethylene bis(2-bromoisobutyrate), Pentaerythritol tetrakis(2-bromoisobutyrate), Dipentaerythritol hexakis(2-bromoisobutyrate), and 1,1,1-Tris(2-bromoisobutyryloxymethyl)ethane.

8. The hydrogel as defined in any of the preceding claims wherein the dendritic core includes:
25 a multi-functional central molecule; and
a plurality of atom transfer radical polymerization mono-initiators attached to the multi-functional central molecule.

9. The hydrogel as defined in claim 8, wherein the atom transfer radical polymerization
30 mono-initiator is selected from the group consisting of 2-azidoethyl 2-bromoisobutyrate, poly(ethylene glycol) methyl ether 2-bromoisobutyrate, 2-(2-Bromoisobutyryloxy)ethyl methacrylate, Dodecyl 2-bromoisobutyrate, 2-Hydroxyethyl 2-bromoisobutyrate, 1-(Phthalimidomethyl) 2-bromoisobutyrate, and Propargyl 2-bromoisobutyrate.

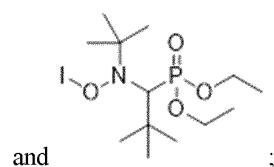
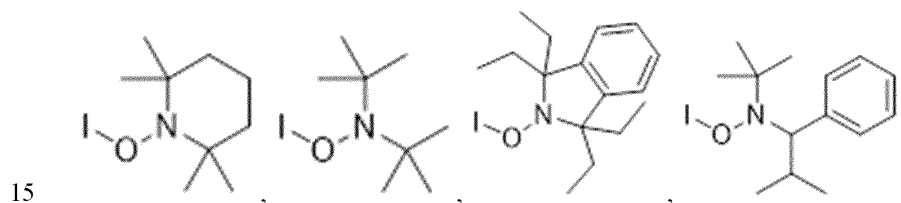
35 10. The hydrogel as defined in any of the preceding claims wherein the dendritic core includes a nitroxide mediated polymerization initiator in each arm.

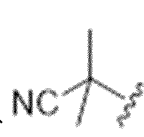
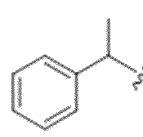
11. The hydrogel as defined in claim 10, wherein the dendritic core is selected from the group consisting of 1,3,5-tris((4-(1-((2,2,6,6-tetramethylpiperidin-1-yl)oxy)ethyl)benzyl)oxy)benzene and 1,3,5-tris((3,5-bis((4-(1-((2,2,6,6-tetramethylpiperidin-1-yl)oxy)ethyl)benzyl)oxy)benzyl)oxy)benzene.

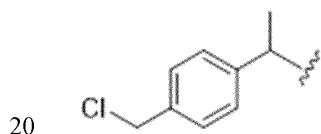
12. The hydrogel as defined in any of the preceding claims wherein the dendritic core includes:

- a multi-functional central molecule; and
 10 a plurality of nitroxide mediated polymerization mono-initiators attached to the multi-functional central molecule.

13. The hydrogel as defined in claim 12, wherein each of the plurality of nitroxide mediated polymerization mono-initiators has a structure selected from the group consisting of:



and wherein I is selected from the group consisting of , , and



14. The hydrogel as defined in any of the preceding claims, wherein the first acrylamide
5 monomer and the second acrylamide monomer form a block copolymer, a random copolymer, a statistical copolymer, or an alternating copolymer in each arm of the dendritic core.

15. The hydrogel as defined in any of the preceding claims wherein second acrylamide
monomer is azido acetamido pentyl acrylamide.
10

16. A flow cell, comprising:
a substrate; and
a hydrogel according to any of the preceding claims on the substrate.

17. The flow cell as defined in claim 16, wherein the substrate includes a plurality of
15 depressions separated by interstitial regions, and wherein the hydrogel is positioned within each of the depressions.

18. The flow cell as defined in claim 16 or 17, further comprising amplification primers
20 grafted to polymeric hydrogel.

19. The flow cell as defined in any of the claims 16-18 wherein the substrate includes a
channel, and wherein the hydrogel is positioned in the channel.

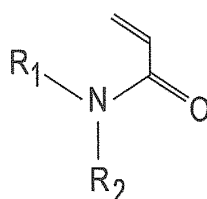
20. The flow cell as defined in any of the claims 16-19 wherein:
25 the first acrylamide monomer and the second acrylamide monomer form a random copolymer in each arm of the dendritic core; or
the first acrylamide monomer and the second acrylamide monomer form a statistical
copolymer in each arm of the dendritic core; or
30 the first acrylamide monomer and the second acrylamide monomer form an alternating
copolymer in each arm of the dendritic core; or
the first acrylamide monomer and the second acrylamide monomer form a block
copolymer in each arm of the dendritic core.

35

21. A method, comprising:

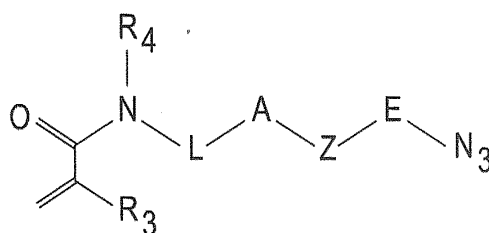
incorporating a copolymer into each arm of a multi-arm dendritic core component having from 2 arms to 30 arms, wherein the copolymer includes a first acrylamide monomer and a second acrylamide monomer, and wherein:

5 the first acrylamide monomer has a structure:



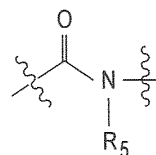
wherein R₁ and R₂ are independently selected from the group consisting of an alkyl, an alkylamino, an alkylamido, an alkylthio, an aryl, a glycol, and optionally substituted variants thereof; and

the second acrylamide monomer has a structure:



10

wherein R₃ is hydrogen or an alkyl; R₄ is hydrogen or an alkyl; L is a linker including a linear chain of 2 atoms to 20 atoms wherein each atom is independently selected from the group consisting of carbon, oxygen, and nitrogen and optional substituents on any carbon and any nitrogen atoms in



the chain; A is an N substituted amide having a structure , where R₅ is hydrogen

15 or an alkyl; E is a linear chain of 1 atom to 4 atoms wherein each atom is independently selected from the group consisting of carbon, oxygen and nitrogen, and optional substituents on any carbon and any nitrogen atoms in the chain; and Z is an optional nitrogen containing heterocycle.

22. The method as defined in claim 21 wherein the incorporating involves polymerizing
20 a mixture of the first acrylamide monomer and the second acrylamide monomer in the presence of the multi-arm component.

23. The method as defined in claim 21 or 22 , wherein the incorporating involves forming a block copolymer in the presence of the multi-arm component by:

i) polymerizing a first block with the first acrylamide monomer in the presence of the multi-arm component to form a modified multi-arm component; and

5 then polymerizing a second block with the second acrylamide monomer in the presence of the modified multi-arm component; or

ii) polymerizing a first block with the second acrylamide monomer in the presence of the multi-arm component to form a modified multi-arm component; and

10 then polymerizing a second block with the first acrylamide monomer in the presence of the modified multi-arm component.

24. The method as defined in any of the claims 21-23 wherein the incorporating involves reversible addition-fragmentation chain transfer polymerization or atom transfer radical polymerization or nitroxide mediated polymerization.

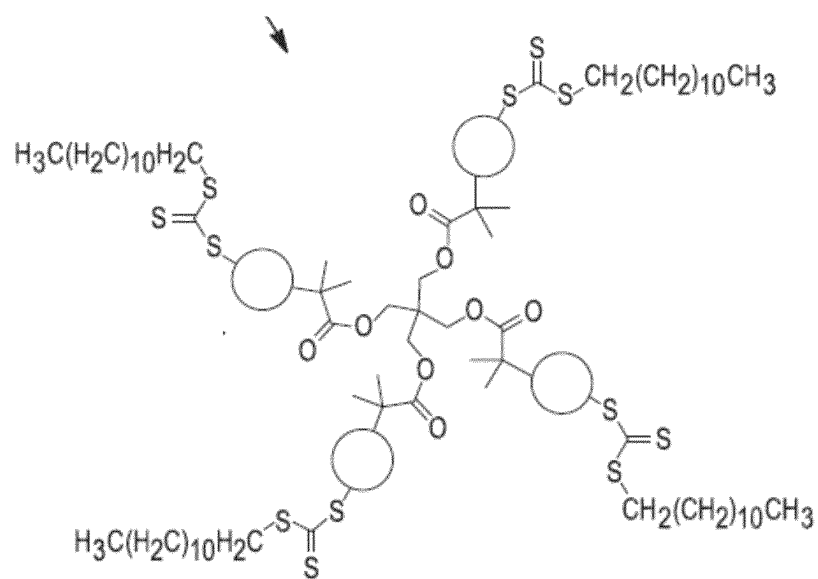
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25. A medical device coated with a hydrogel according to any of the claims 1-15.

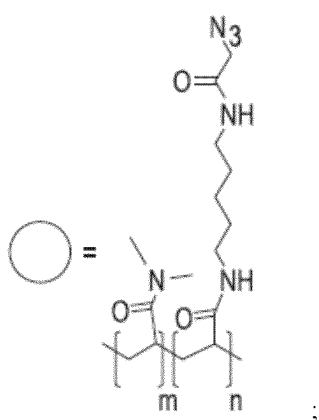
26. A wound dressing coated with a hydrogel according to any of the claims 1-15.

20 27. A substrate coated with a hydrogel according to any of the claims 1-15 for use in sequencing analysis.

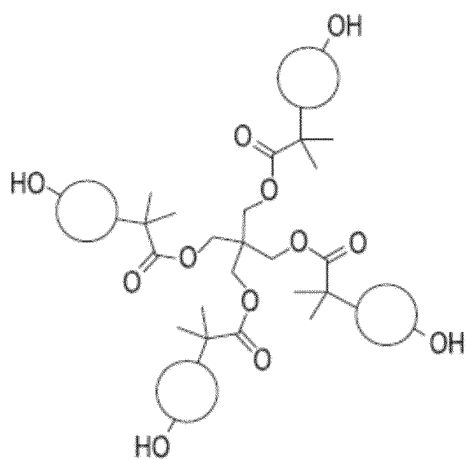
28. The hydrogel according to any of the claims 1-15 having the structure (10):



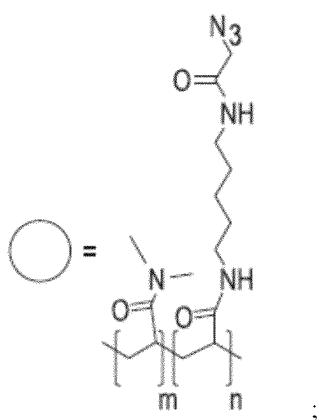
5 wherein:



or the structure:

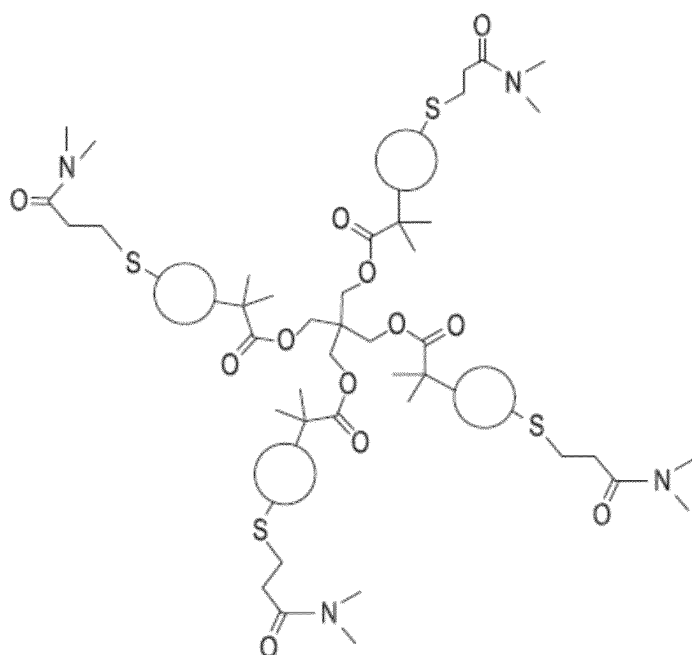


wherein:

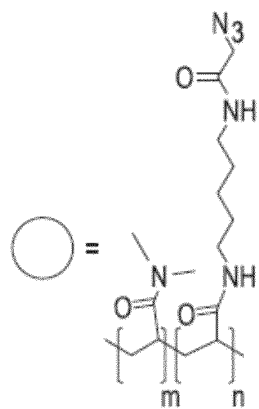


5

or the structure:



wherein:



5

depicted in Fig -1B

or Fig-1C in the description.

10

29. The hydrogel according to any of the claims 1-15, 28 having a dispersity of lower than 2.5, in particular between 1.8 and 2.0, preferably lower than 1.7, more preferably lower than 1.3.

5 30. Hydrogel according to any of the claims 1-15, wherein the dendritic core has a multi-functional central molecule selected from the group consisting of phenyl group, benzoic acid, pentaerythritol, and a phosphazene group.

10 31. Hydrogel according to any of the claims 1-15, wherein the dendritic core has 2 arms, 3 arms, 4 arms, 6 arms or 8 arms.

32. The method as defined in any of the claims 22-24 wherein the multi-arm component comprises a multi-functional central molecule and each arm thereof comprises a thiocarbonylthio group or an initiator selected from the group consisting of atom transfer radical polymerization (ATR) initiator and a nitroxide mediated polymerization mono-initiator.

33. The method as defined in any of the claims 22-24, 32, wherein the second acrylamide monomer comprises an azide group, wherein the method additionally comprises at least one of:

20 attaching the multi-arm polymeric hydrogel to the surface of a substrate by reaction of an azide group of the formed multi-arm polymeric hydrogel;

attaching a primer to an arm of the multi-arm polymeric hydrogel by reaction of an azide group of the formed multi-arm polymeric hydrogel; and

25 cross-linking of the formed multi-arm polymeric hydrogel 10 by reaction of an azide group of the formed multi-arm polymeric hydrogel.