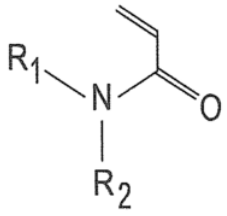
CLAIMS

1. A hydrogel, comprising:

a dendritic core having from 2 arms to 30 arms;

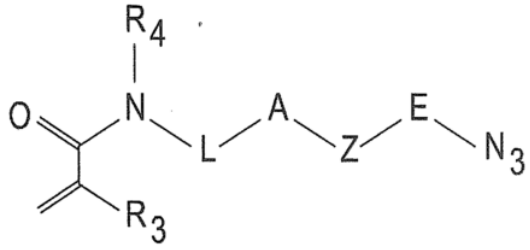
a first acrylamide monomer incorporated into each arm of the dendritic core, the first acrylamide monomer having a structure:



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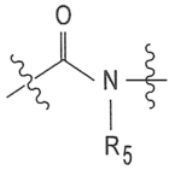
wherein R_1 and R_2 are independently selected from the group consisting of an alkyl, an alkylamino, an alkylamido, an alkylthio, an aryl, a glycol, and optionally substituted variants thereof; and

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 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.

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 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.

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].

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, 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:

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 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.

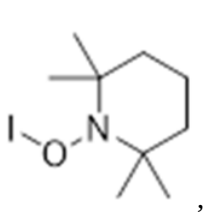
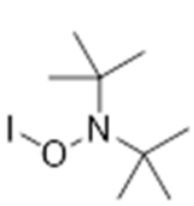
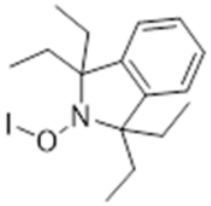
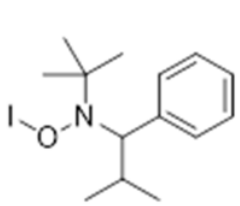
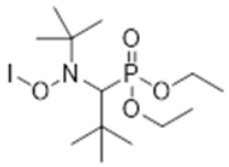
10. The hydrogel as defined in any of the preceding claims wherein the dendritic core includes a nitroxide mediated polymerization initiator in each arm.

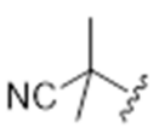
11. The hydrogel as defined in claim 10, wherein the dendritic core is selected from the group consisting of 1,3,5-tris((4-(1-((2,2,6,6-tetramethylpiperidin-1-yl)oxy)ethyl)benzyl)oxy)benzene and 1,3,5-tris((3,5-bis((4-(1-((2,2,6,6-tetramethylpiperidin-1-yl)oxy)ethyl)benzyl)oxy)benzyl)oxy)benzene.

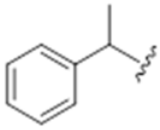
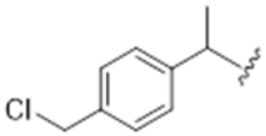
12. The hydrogel as defined in any of the preceding claims wherein the dendritic core includes:

a multi-functional central molecule; and

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 ;

and wherein I is selected from the group consisting of 

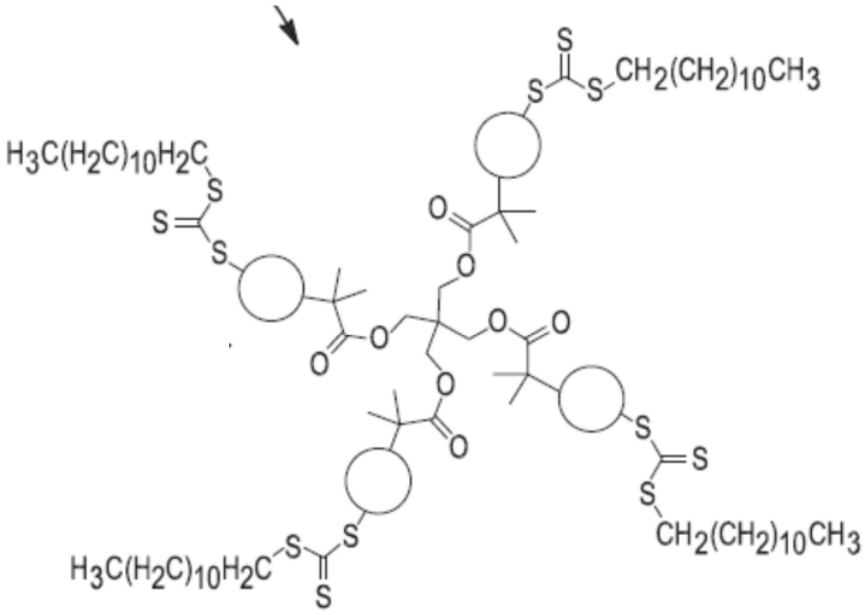
, 
, and 

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14. The hydrogel as defined in any of the preceding claims, wherein the first acrylamide 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.

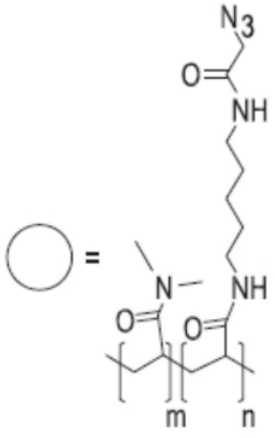
15. The hydrogel as defined in any of the preceding claims wherein second acrylamide monomer is azido acetamido pentyl acrylamide.

16. The hydrogel according to claim 1 having the structure (10):



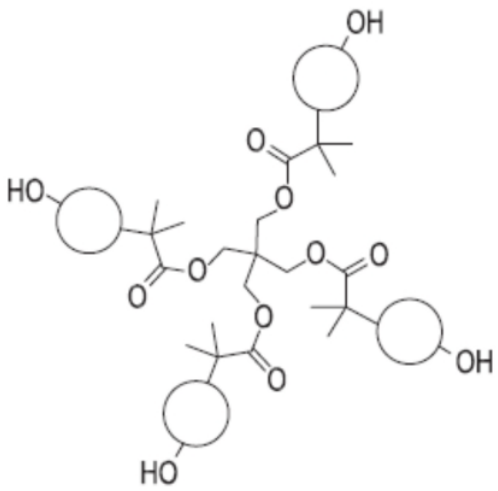
,

wherein:



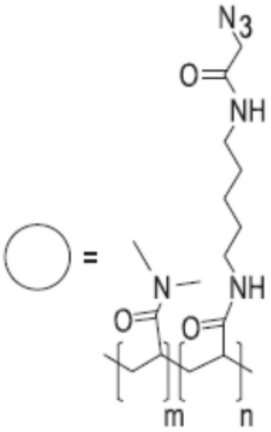
;

or the structure:



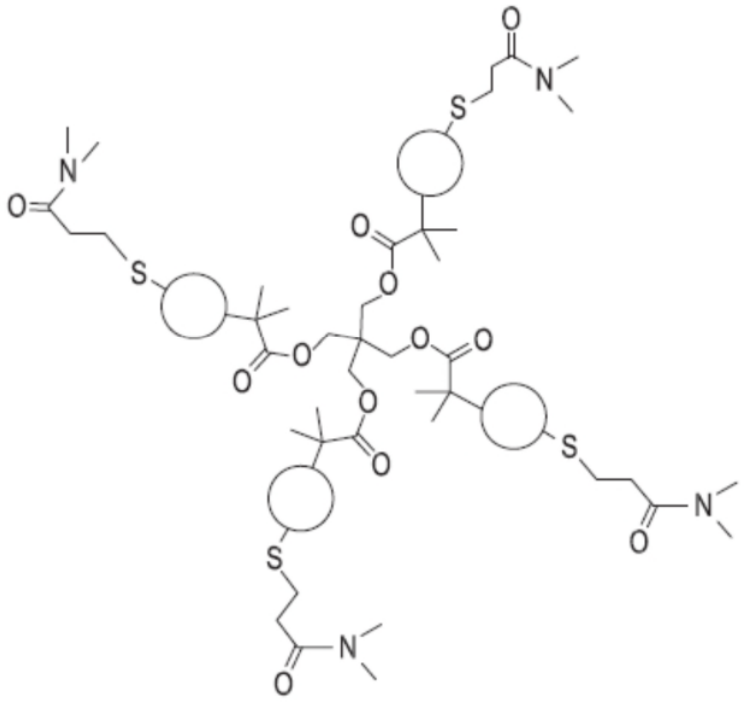
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wherein:

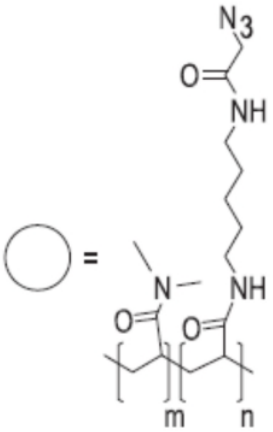


;

or the structure:



wherein:



depicted in Fig -1B

or Fig-1C in the description.

17. The hydrogel according to any one of claims 1 to 16, having a dispersity of lower than 2.5, in particular between 1.8 and 2.0 in particular between 1.8 and 2.0, preferably lower than 1.7, more preferably lower than 1.3.

18. The hydrogel according to any one of claims 1 to 15, wherein the dendritic core has a multi-functional central molecule selected from the group consisting of phenyl group, benzoic acid, pentraerythritol, and a phosphazene group.

19. The hydrogel according to any one of claims 1 to 15, wherein the dendritic core has 2 arms, 3 arms, 4 arms, 6 arms or 8 arms.

20. A flow cell, comprising:

a substrate; and

a hydrogel according to any of the preceding claims on the substrate.

21. The flow cell as defined in claim 20, wherein the substrate includes a plurality of depressions separated by interstitial regions, and wherein the hydrogel is positioned within each of the depressions.

22. The flow cell as defined in claim 20 or 21, further comprising amplification primers grafted to polymeric hydrogel.

23. The flow cell as defined in any of the claims 20 - 22, wherein the substrate includes a channel, and wherein the hydrogel is positioned in the channel.

24. The flow cell as defined in any of the claims 20 - 23, wherein:

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

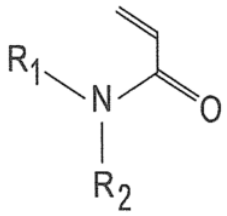
the first acrylamide monomer and the second acrylamide monomer form an alternating copolymer in each arm of the dendritic core; or

the first acrylamide monomer and the second acrylamide monomer form a block copolymer in each arm of the dendritic core.

25. 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:

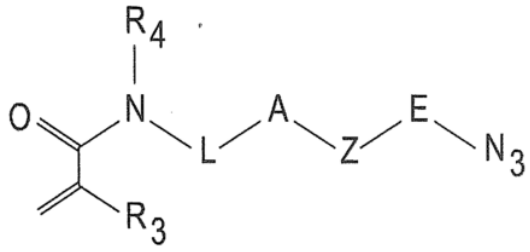
the first acrylamide monomer has a structure:



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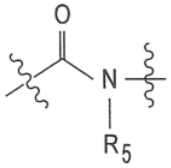
wherein R_1 and R_2 are independently selected from the group consisting of an alkyl, an alkylamino, an alkylamido, an alkylthio, an aryl, a glycol, and optionally substituted variants thereof; and

the second acrylamide monomer has 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 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.

26. The method as defined in claim 25, wherein the incorporating involves polymerizing a mixture of the first acrylamide monomer and the second acrylamide monomer in the presence of the multi-arm component.

27. The method as defined in claim 25 or 26, 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

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

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

28. The method as defined in any of the claims 25-27, wherein the incorporating involves reversible addition-fragmentation chain transfer polymerization or atom transfer radical polymerization or nitroxide mediated polymerization.

29. The method as defined in any of the claims 26-28 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.

30. The method as defined in any of the claims 28 - 31, wherein the second acrylamide monomer comprises an azide group, wherein the method additionally comprises at least one of:

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

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

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

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

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