CLAIMS

1. A flow cell, comprising:

a substrate; and

a cured, patterned resin on the substrate, the cured, patterned resin including nano-depressions separated by interstitial regions, the nano-depressions each having a largest opening dimension ranging from 10 nm to 1000 nm, and the cured, patterned resin including an interpenetrating polymer network including an epoxy-based polymer and a (meth)acryloyl-based polymer, wherein a weight ratio of the epoxy-based polymer to the (meth)acryloyl-based polymer ranges from 25:75 to 75:25.

2. The flow cell as defined in claim 1, further comprising:

a grating layer positioned on the substrate; and

a planar waveguide layer positioned on the grating layer.

3. The flow cell as defined in claim 2, wherein:

a refractive index of the interpenetrating polymer network ranges from 1.35 to 1.52; and

a refractive index of the planar waveguide layer ranges from 1.6 to 2.5.

4. The flow cell as defined in claim 1, further comprising:

a hydrogel positioned in each of the nano-depressions; and

amplification primers attached to the hydrogel.

5. The flow cell as defined in claim 1, wherein a thickness of the cured, patterned resin ranges from 225 nm to 600 nm.

6. A method, comprising:

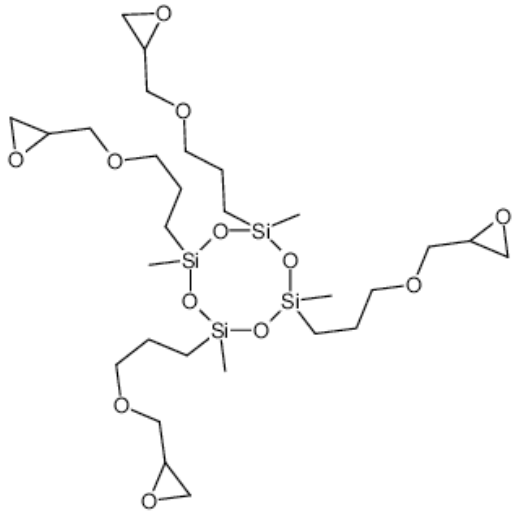
applying a resin mixture on a substrate of a flow cell, the resin mixture including a multi-functional epoxy monomer and a multi-functional (meth)acryloyl monomer at a weight ratio ranging from 25:75 to 75:25;

imprinting the resin mixture with a working stamp having a plurality of nano-features; and

curing the resin mixture while the working stamp is in place, thereby forming an interpenetrating polymer network including an epoxy-based polymer and a (meth)acryloyl-based polymer at a weight ratio ranging from 25:75 to 75:25 that is imprinted with flow cell nano-depressions separated by interstitial regions, the nano-depressions each having a largest opening dimension ranging from 10 nm to 1000 nm.

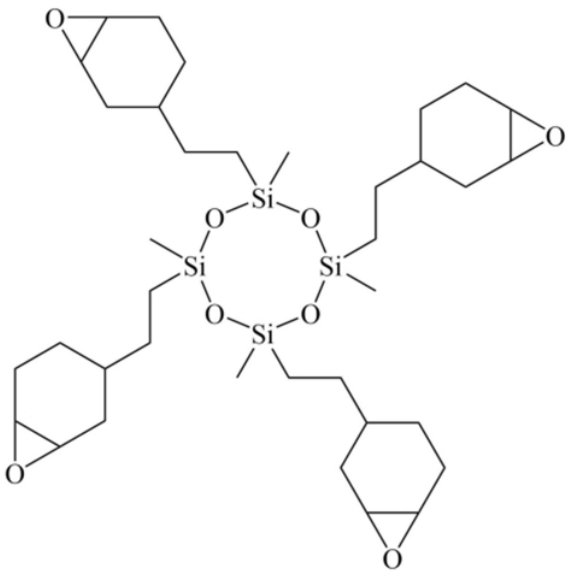
7. The method as defined in claim 6, wherein the multi-functional epoxy monomer is selected from the group consisting of:

i) 2,4,6,8-tetramethyl-2,4,6,8-tetrakis(propyl glycidyl ether)cyclotetrasiloxane:



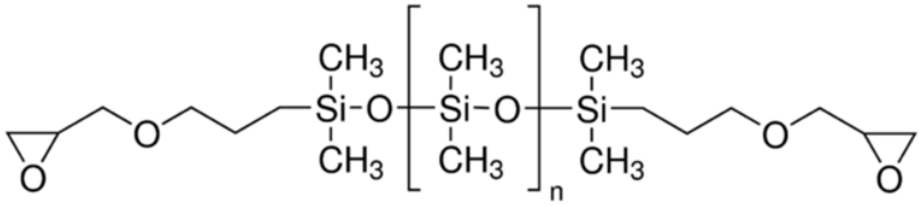
;

ii) Tetrakis(epoxycyclohexyl ethyl)tetramethyl cyclotetrasiloxane:



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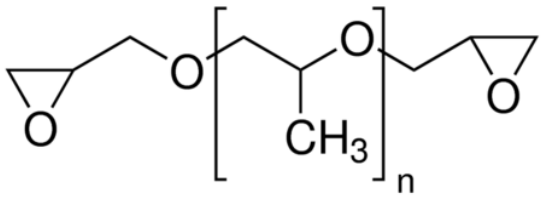
iii) Poly(dimethylsiloxane), diglycidyl ether terminated:



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wherein $4 < n < 8$;

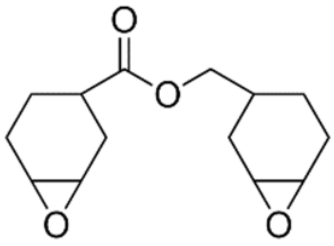
iv) Poly(propylene glycol) diglycidyl ether:



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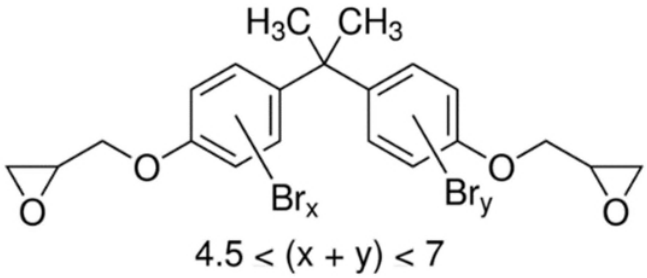
wherein 5 < n < 10;

v) 3,4-Epoxycyclohexylmethyl 3,4-epoxycyclohexanecarboxylate:



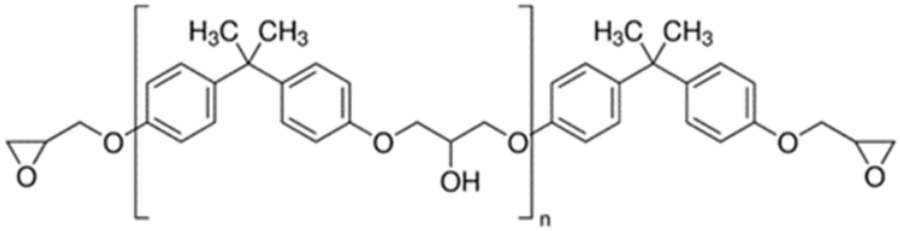
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vi) Bisphenol A diglycidyl ether, brominated:



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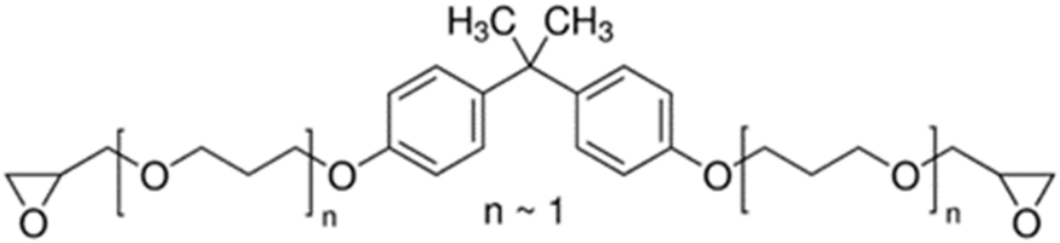
vii) Poly(Bisphenol A-co-epichlorohydrin), glycidyl end-capped:



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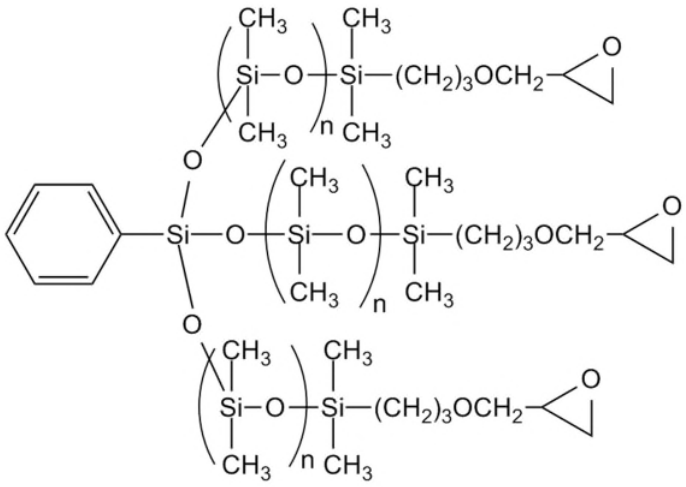
wherein 0 < n < 2;

viii) Bisphenol A propoxylate diglycidyl ether:



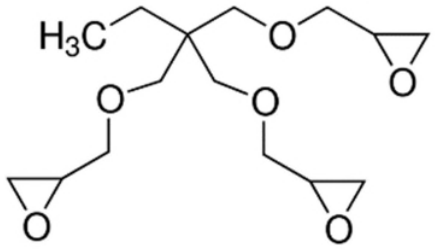
;

ix) Monophenyl functional tris(epoxy terminated polydimethylsiloxane):



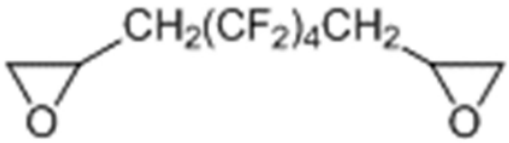
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x) Trimethylolpropane triglycidyl ether:



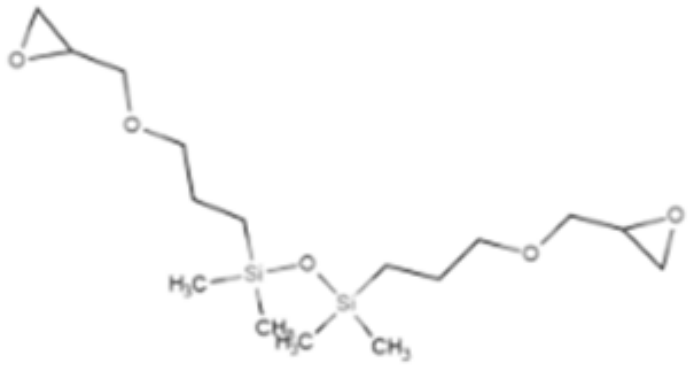
;

xi) 2,2'-(2,2,3,3,4,4,5,5-Octafluorohexane-1,6-diyl)bis(oxirane):



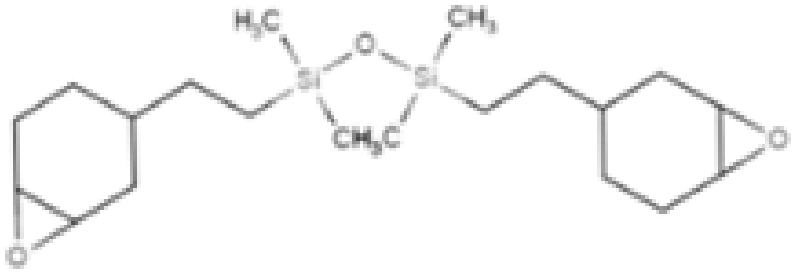
;

xii) 1,3-Bis(3-glycidoxypropyl)tetramethyldisiloxane:



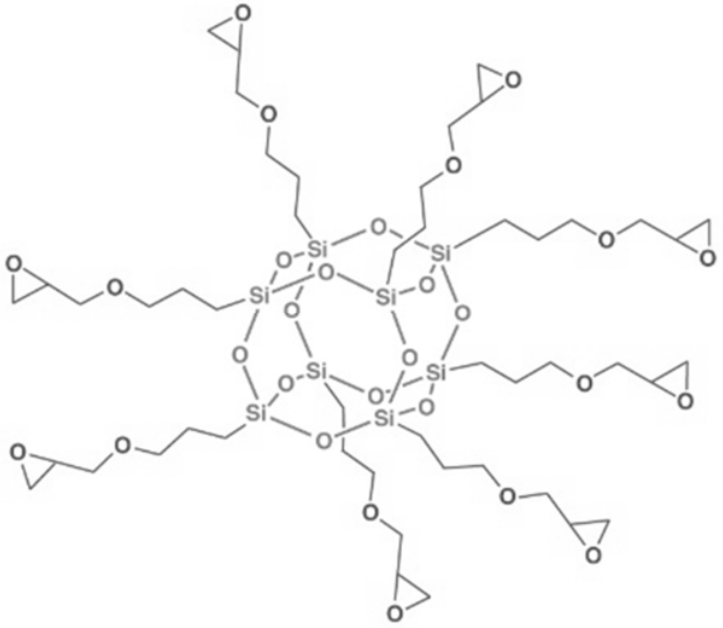
;

xiii) 1,3 Bis[2(3,4 epoxycyclohex-1-yl)ethyl]tetra-methyldisiloxane:



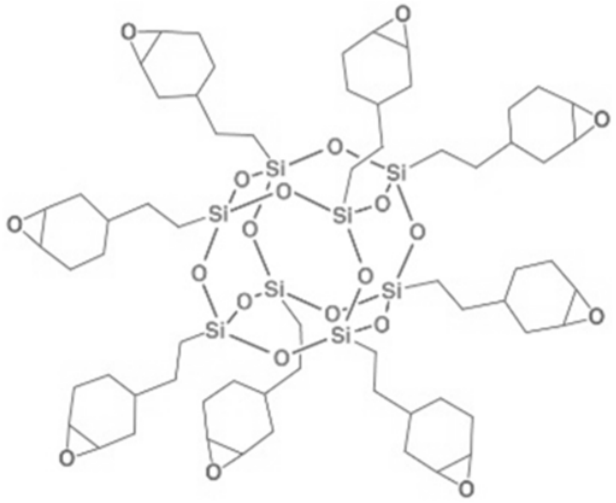
;

xiv) Glycidyl polyoctahedral silsesquioxane:



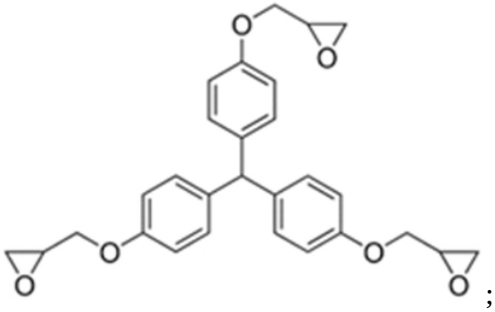
; and

xv) Epoxycyclohexyl polyoctahedral silsesquioxane:



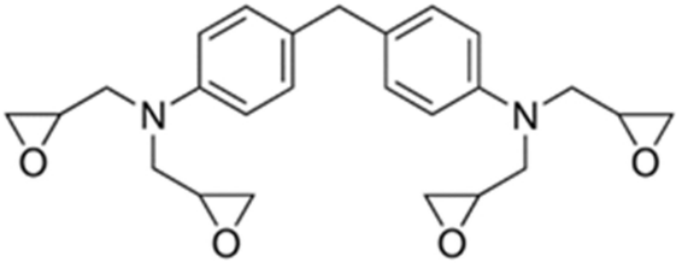
;

xvi) Tris(4-hydroxyphenyl)methane triglycidyl ether:



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xvii) 4,4′-Methylenebis(N,N-diglycidylaniline):

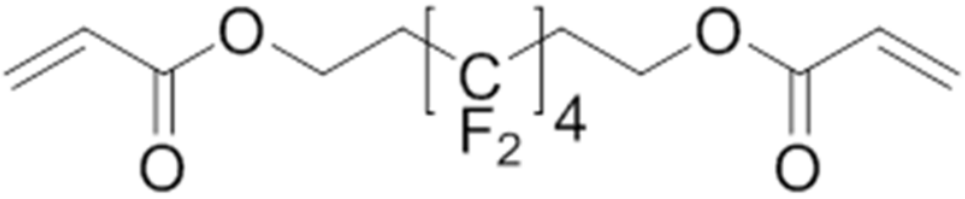


; and

xviii) any combination of i) through xvii).

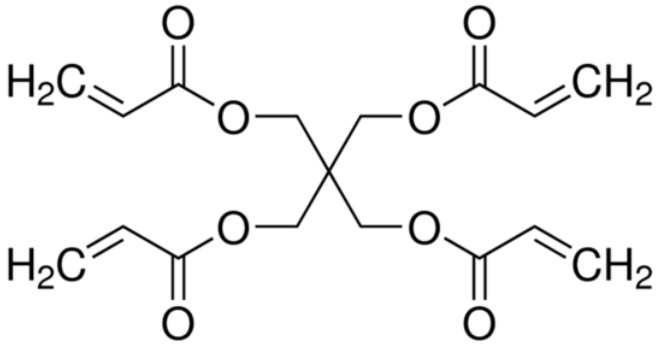
8. The method as defined in claim 6, wherein the multi-functional (meth)acryloyl monomer is selected from the group consisting of:

i) 2,2,3,3,4,4,5,5-octafluoro-1,6-hexanediol diacrylate:



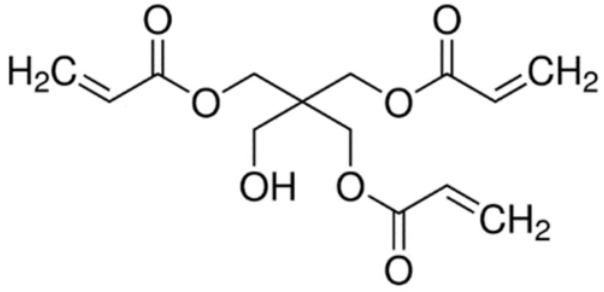
;

ii) Pentaerythritol tetraacrylate:



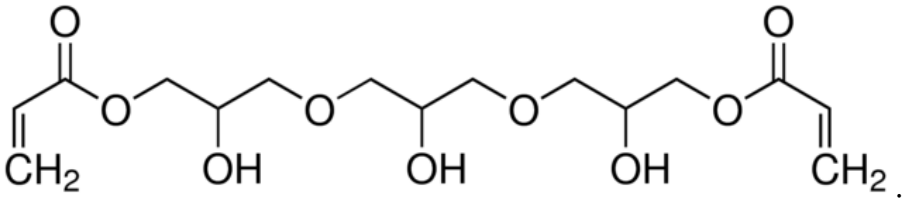
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iii) Pentaerythritol triacrylate:



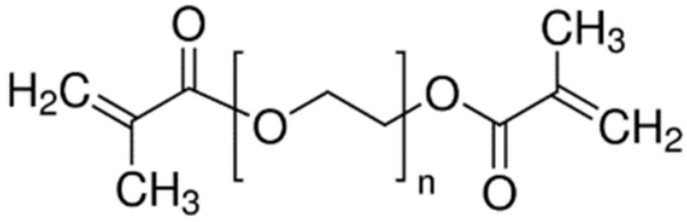
;

iv) Glycerol 1,3-diglycerolate diacrylate:



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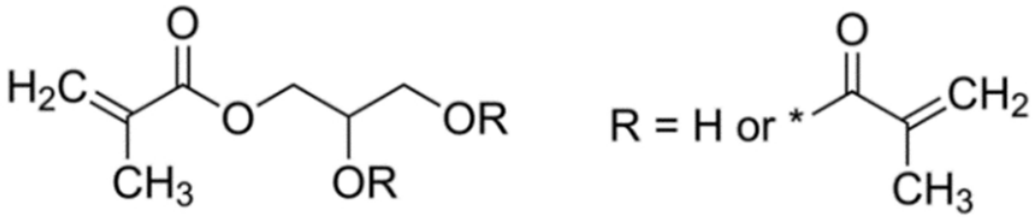
v) Poly(ethylene glycol) dimethacrylate:



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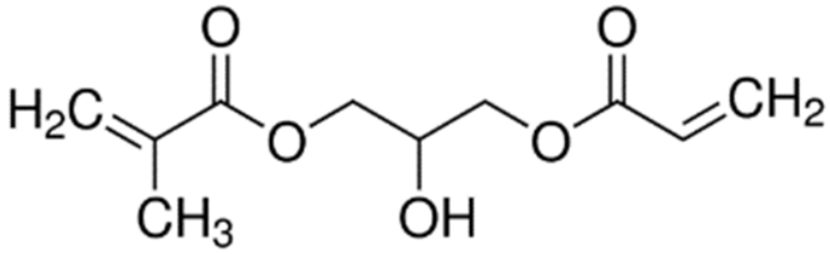
wherein 8 < n < 10;

vi) Glycerol dimethacrylate, mixture of isomers:



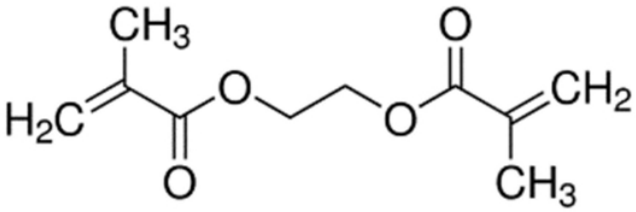
;

vii) 3-(Acryloyloxy)-2-hydroxypropyl methacrylate:



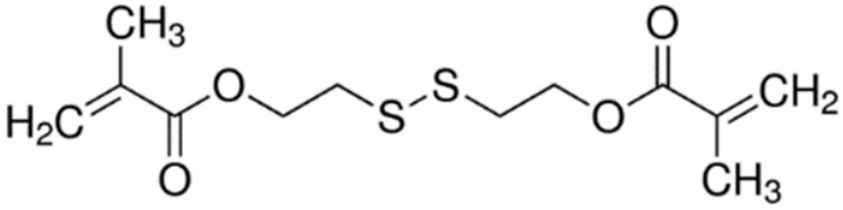
;

viii) Ethylene glycol dimethacrylate:



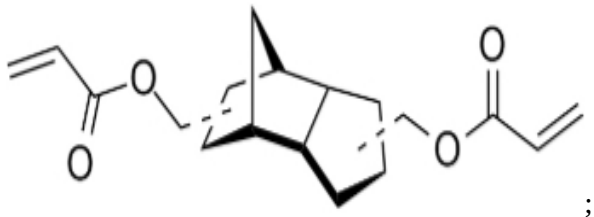
;

ix) Bis(2-methacryloyl)oxyethyl disulfide:



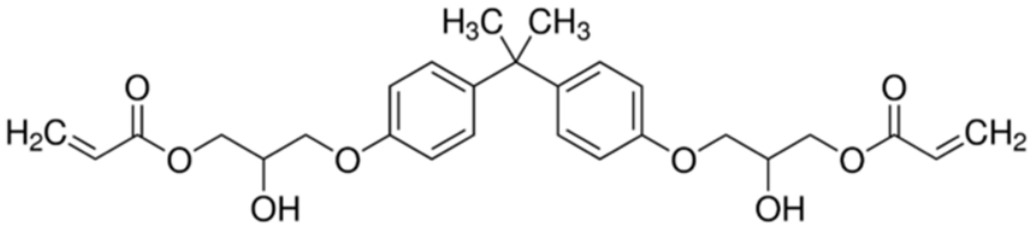
;

x) Tricyclodecane dimethanol diacrylate:



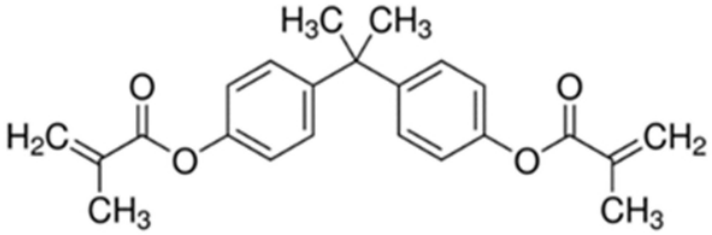
;

xi) Bisphenol A glycerolate (1 glycerol/phenol) diacrylate:



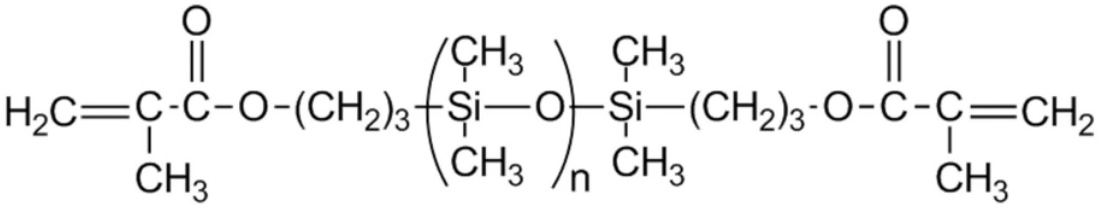
;

xii) Bisphenol A dimethacrylate:



;

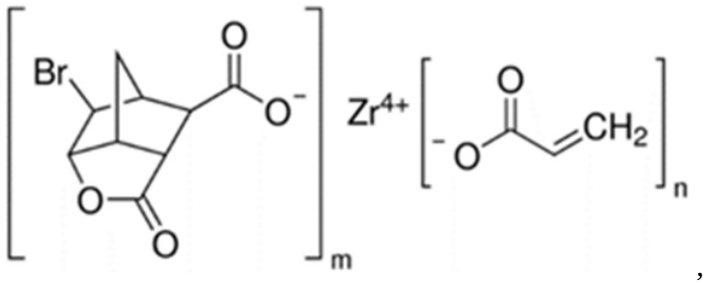
xiii) Methacryloxypropyl terminated polydimethylsiloxane:



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wherein n is selected to render the monomer with a molecular weight of about 420 g/mol, 950 g/mol, 4,000 g/mol, 10,000 g/mol, or 25,000 g/mol;

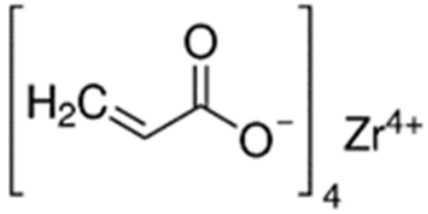
xiv) Zirconium bromonorbornanelactone carboxylate acrylate:



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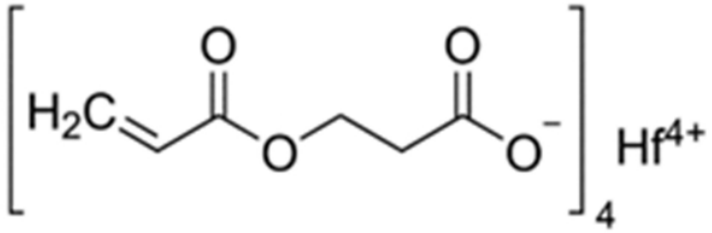
wherein m ranges from 0 to 4, n ranges from 0 to 4, and m + n = 4;

xv) Zirconium acrylate:



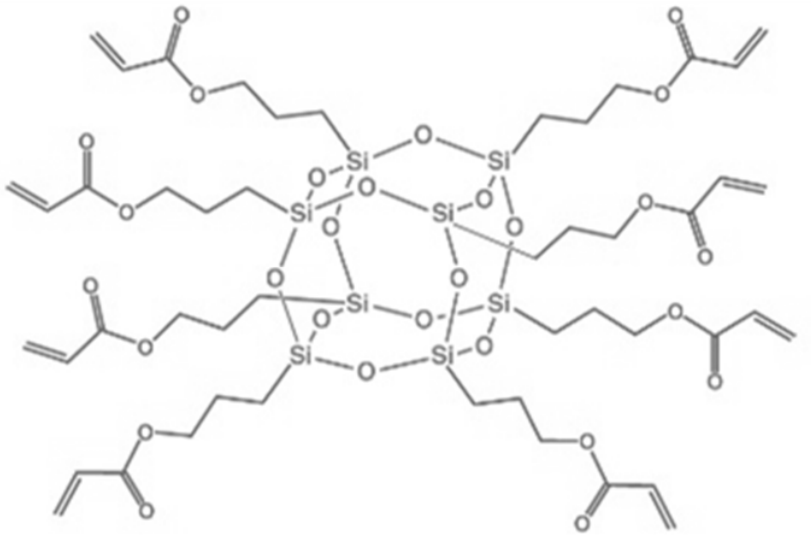
;

xvi) Hafnium carboxyethyl acrylate:



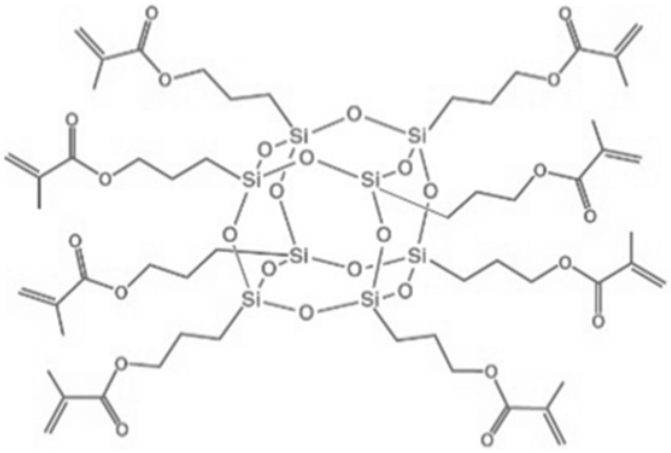
;

xvii) Acrylo polyoctahedral silsesquioxane:

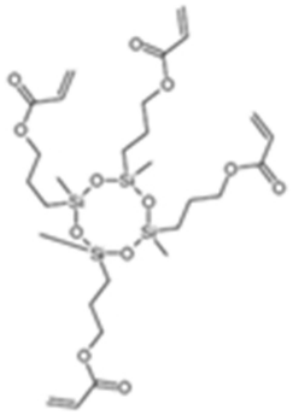


;

xviii) Methacryl polyoctahedral silsesquioxane:


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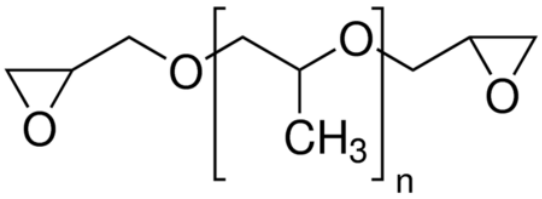
xix) 2,4,6,8-Tetramethyl-2,4,6,8-tetrakis(3-acryloyloxypropyl) cyclotetrasiloxane:


; and

xx) any combination of i) through xix).

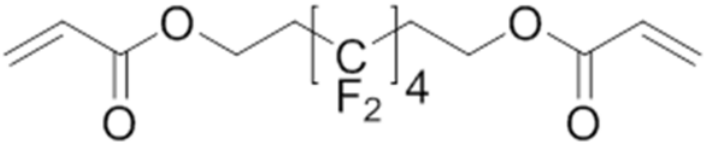
9. The method as defined in claim 6, wherein:

the multi-functional epoxy monomer is Poly(propylene glycol) diglycidyl ether wherein $5 < n < 10$:



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the multi-functional (meth)acryloyl monomer is 2,2,3,3,4,4,5,5-octafluoro-1,6-hexanediol diacrylate:

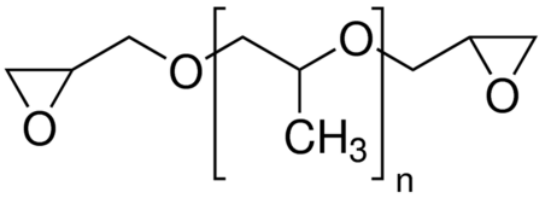


; and

the predetermined weight ratio is 50:50.

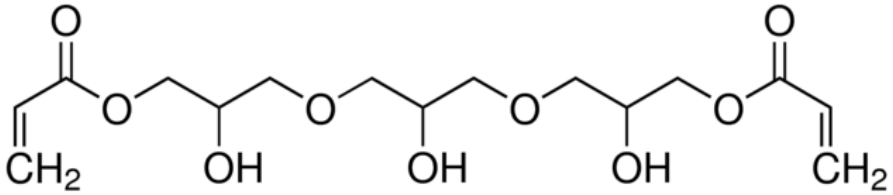
10. The method as defined in claim 6, wherein:

the multi-functional epoxy monomer is Poly(propylene glycol) diglycidyl ether wherein $5 < n < 10$:



,

the multi-functional (meth)acryloyl monomer is Glycerol 1,3-diglycerolate diacrylate:



; and

the predetermined weight ratio ranges from 25:75 to 75:25.