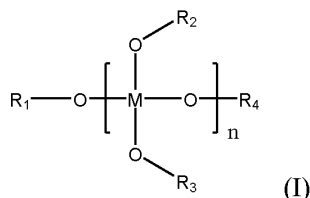


Claims

We claim:

1. A composition comprising:
 - a) a metal compound having the structure (I):



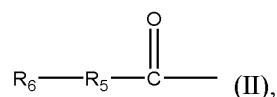
wherein,

M is a metal having a valence of four (4);

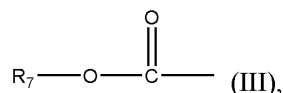
n is an integer from 1 to 20;

each R₁, R₂, R₃, and R₄ is independently selected from the group consisting of:

- 1) a first organic moiety having the structure (II):

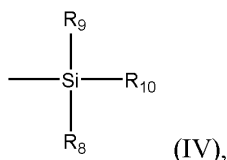


wherein, R₅ is selected from the group consisting of C₂ to C₁₀ alkylenes, C₃ to C₁₂ branched alkylenes, C₅ to C₁₂ cycloalkylenes, C₂ to C₁₀ alkylenes containing a C=C double bond, C₃ to C₁₂ branched alkylenes containing a C=C double bond, and C₅ to C₁₂ cycloalkylenes containing a C=C double bond; and R₆ is hydrogen or an alkyloxycarbonyl having the structure (III),



wherein, R₇ is a C₁ to C₈ alkyl;

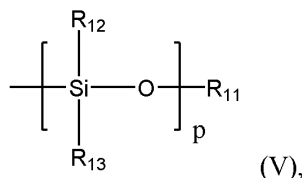
- 2) a silicon bearing organic moiety having at least 2 carbons and having the structure (IV):



wherein,

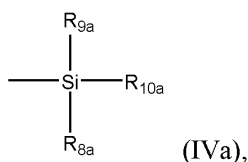
R₈ and R₉ are each independently selected from the group consisting of C₁ to C₈ alkyls, C₃ to C₁₂ branched alkyls, C₁ to C₈ alkyloxys, C₃ to C₁₂ branched alkyloxys, and C₆ to C₁₆ aryls;

R₁₀ is selected from the group consisting of C₁ to C₈ alkyls, C₆ to C₁₆ aryls, hydroxyl and siloxanes having the structure (V):



wherein,

R₁₁ is selected from the group consisting of hydrogen, C₁ to C₈ alkyls, C₁ to C₈ alkyls substituted with a hydroxyl, a C₆ to C₁₆ aryl, and a silyl moiety having structure (IVa) wherein, R_{8a} and R_{9a} are each independently selected from the group consisting of C₁ to C₈ alkyls, C₃ to C₁₂ branched alkyls, C₁ to C₈ alkyloxys, C₃ to C₁₂ branched alkyloxys, and C₆ to C₁₆ aryls, and R_{10a} is selected from the group consisting of C₁ to C₈ alkyls, and C₆ to C₁₆ aryls;

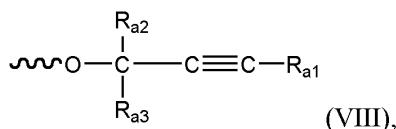


R₁₂ and R₁₃ are each independently selected from the group consisting of C₁ to C₈ alkyls, C₃ to C₁₂ branched alkyls, C₁ to C₈ alkyloxys, C₃ to C₁₂ branched alkyloxys, and C₆ to C₁₆ aryls; and p represents the number of repeat units in the siloxane moiety (V);

3) a second organic moiety selected from the group consisting of C₂ to C₈ alkyls, C₂ to C₈ alkyl carboxyls, C₆ to C₂₀ aryl carboxyls, fluorenyl carboxyls, fluorinated C₂ to C₈ alkyl carboxyls, C₂ to C₈ alkyl sulfonyls, fluorinated C₂ to C₈ alkyl sulfonyls, and mixtures thereof; and

4) mixtures thereof;

b) a spin on high carbon polymer, having a polymer backbone comprising mono-cyclic aromatic hydrocarbon moieties, fused-ring ring hydrocarbon moieties, or mixtures of these having a wt. % of carbon from about 81 wt. % to about 94 wt. %, which is soluble to at least about 5 wt. % in a spin casting solvent, and wherein at least one, of said mono-cyclic aromatic hydrocarbon or said fused-ring ring hydrocarbon moieties, present in said spin on high carbon polymer, is functionalized with at least one alkynyloxy moiety of structure (VIII),

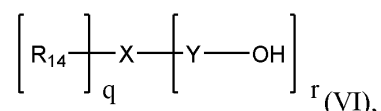


wherein,

$\sim$ represents the attachment point of said alkynyloxy moiety to said mono-cyclic aromatic hydrocarbon moieties or to said fused-ring ring hydrocarbon moieties and R_{a1} is hydrogen, halogen, cyano, unsubstituted C_1 to C_6 alkyl, C_1 to C_6 alkyl substituted with at least one substituent selected from the group consisting of C_1 to C_6 alkyl, halogen and cyano, unsubstituted C_3 to C_{20} aromatic ring, or C_3 to C_{20} aromatic ring substituted with at least one substituent selected from the group consisting of C_1 to C_6 alkyl, halogen and cyano,

R_{a2} and R_{a3} are each independently hydrogen, halogen, cyano, unsubstituted C_1 to C_6 alkyl, C_1 to C_6 alkyl substituted with at least one substituent selected from the group consisting of C_1 to C_6 alkyl, halogen and cyano, unsubstituted C_3 to C_{20} aromatic ring, or C_3 to C_{20} aromatic ring substituted with at least one substituent selected from the group consisting of C_1 to C_6 alkyl, halogen and cyano,

c) an optional component comprised of a polyol additive having the structure (VI):



wherein,

X is C or N;

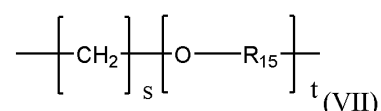
r is at least 2;

q is from 0 to 2;

provided that the sum of q and r is 4 when X is C, and the sum of q and r is 3 when X is N;

R_{14} is selected from the group consisting of hydrogen, C_1 to C_8 alkyls and C_2 to C_8 hydroxyalkyls;

when X is N, Y is a C_1 to C_8 alkylene, or, when X is C, Y is selected from the group consisting of a direct valence bond, C_1 to C_8 alkylenes and moieties having the structure (VII):



wherein,

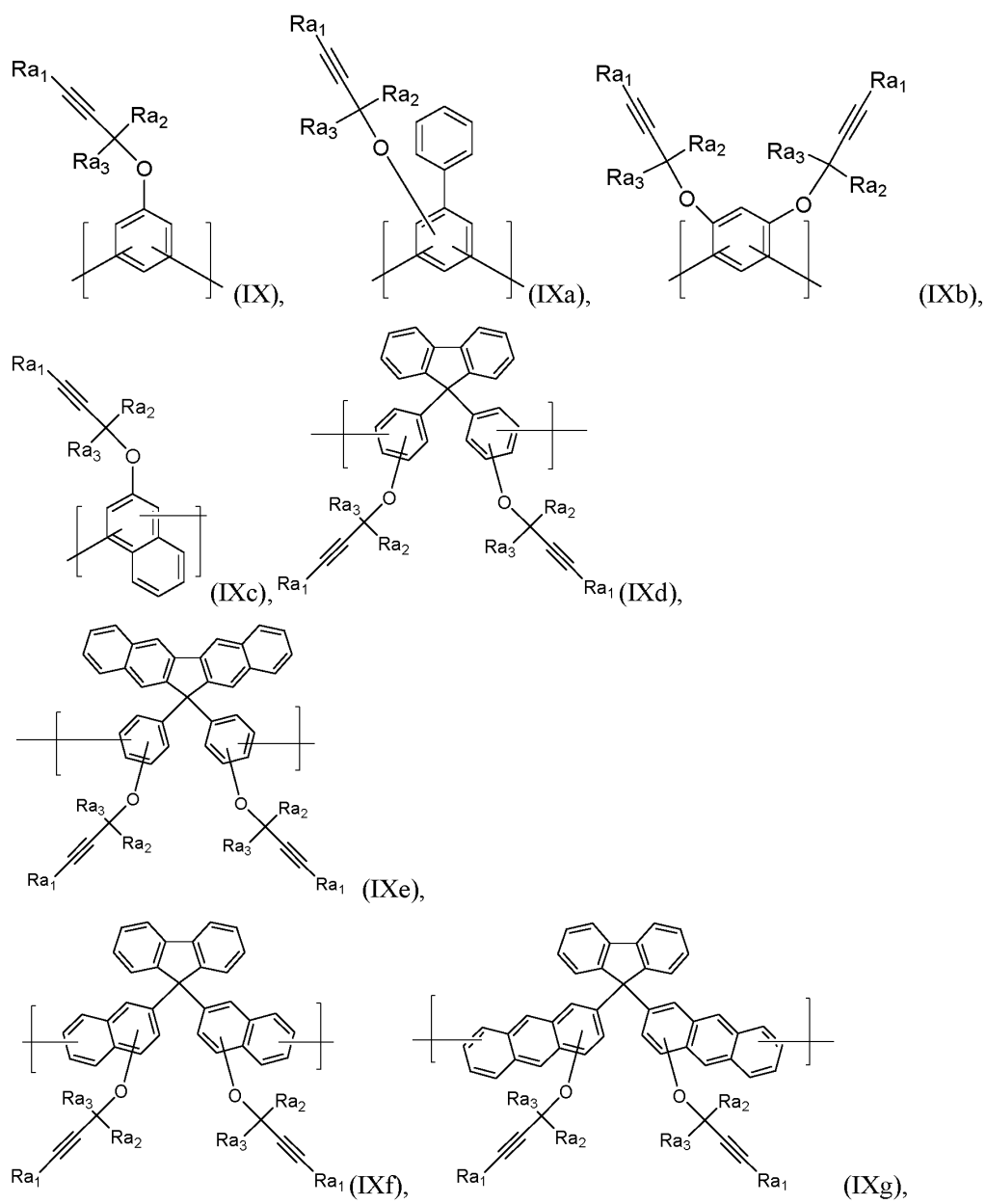
R_{15} is a C_2 to C_8 alkylene;

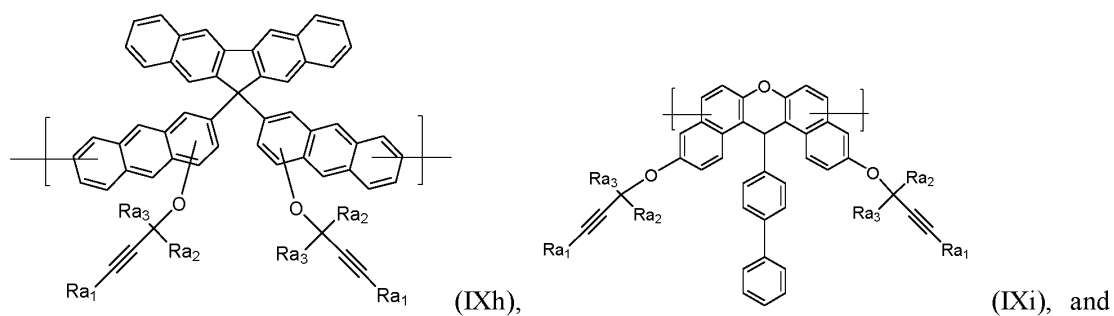
s is 0 to 2; and

t is 1 to 2;

d) a spin casting solvent.

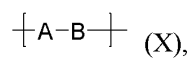
2. The composition according to claim 1 wherein said polymer backbone of said spin on high carbon polymer comprises moieties selected from the group consisting of



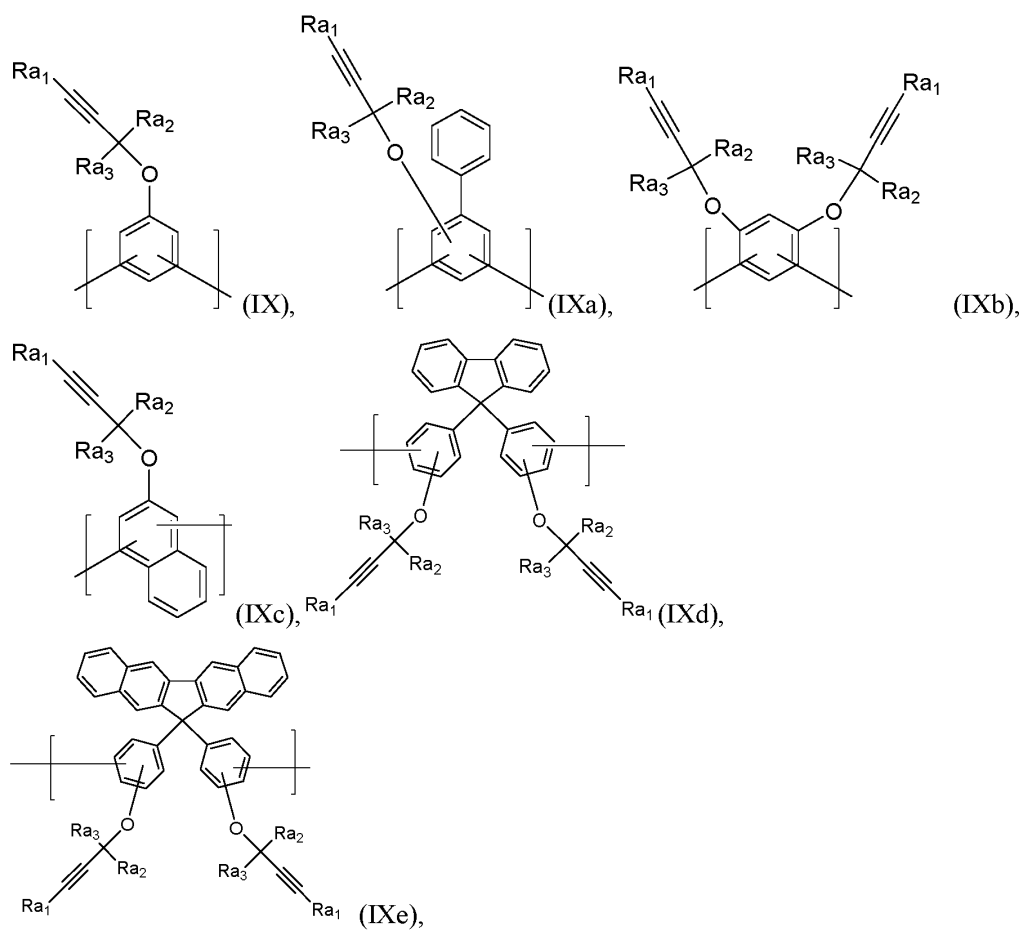


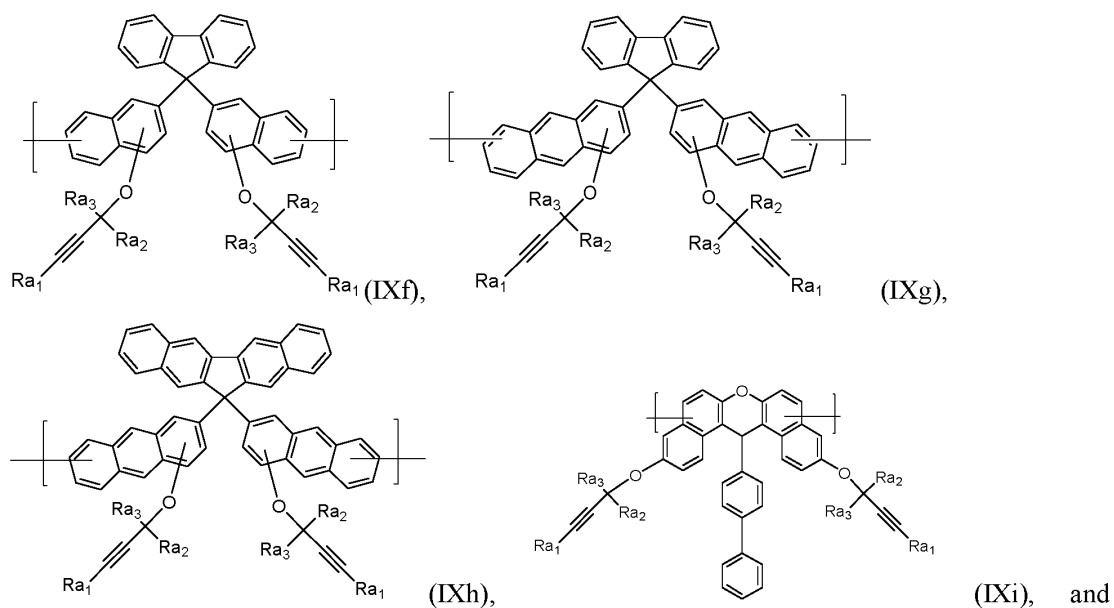
mixtures thereof.

3. The composition of claim 1 or 2 wherein, said spin on high carbon polymer comprises a repeat unit having structure (X),



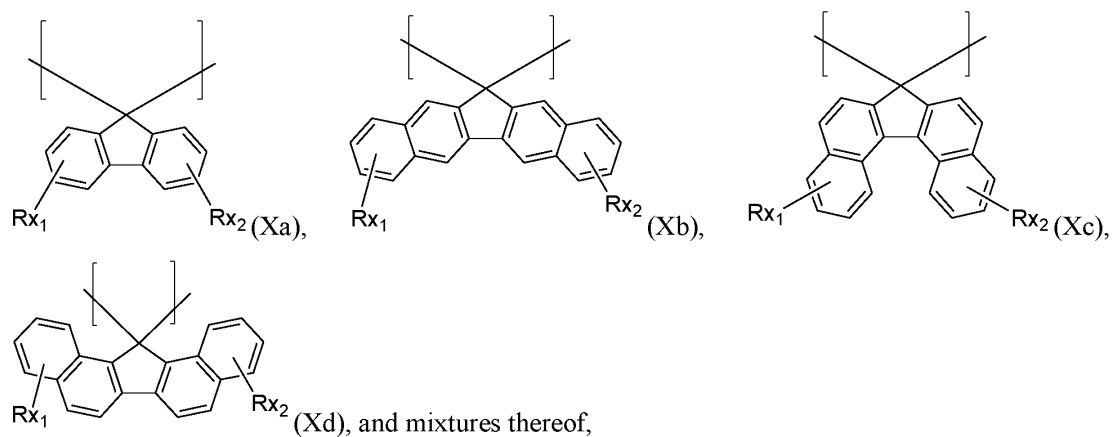
wherein A is selected from the group consisting of





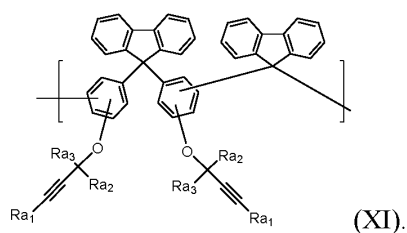
mixtures thereof, and

wherein B is selected from the group consisting of

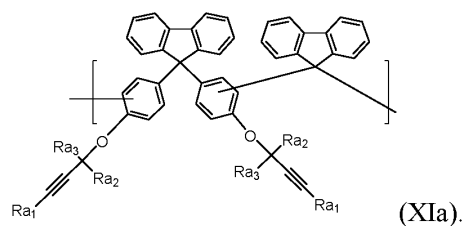


wherein R_{X1} and R_{X2} are independently hydrogen, a C_1 to C_6 alkyl, an aryl moiety, or an alkynyloxy moiety of structure (VIII).

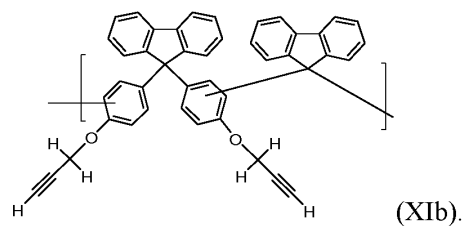
4. The composition of any one of claims 1 to 3 wherein, said spin on high carbon polymer comprises a repeat unit having structure (XI);



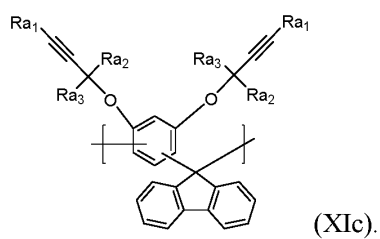
5. The composition of any one of claims 1 to 4 wherein, said spin on high carbon polymer comprises a repeat unit having structure (XIa);



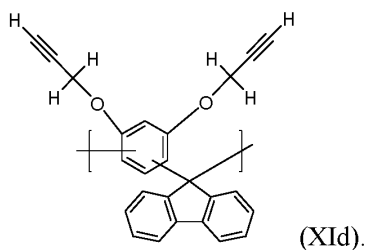
6. The composition of any one of claims 1 to 5 wherein, said spin on high carbon polymer comprises a repeat unit having structure (XIb);



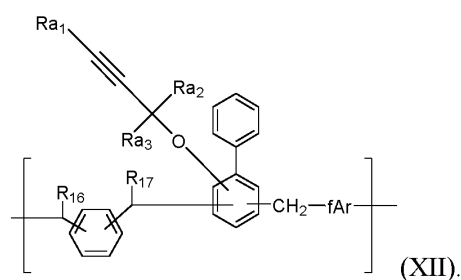
7. The composition of any one of claims 1 to 3 wherein, said spin on high carbon polymer comprises a repeat unit having structure (XIc);



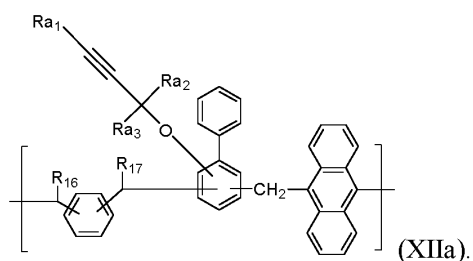
8. The composition of any one of claims 1 to 3 wherein, said spin on high carbon polymer comprises a repeat unit having structure (XIId);



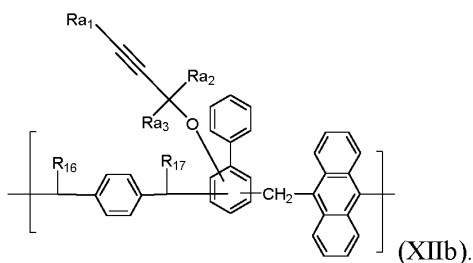
9. The composition of claim 1 or 2, wherein, said spin on high carbon polymer comprises a repeat unit of structure (XII), wherein fAr is a fused aromatic ring, R_{16} and R_{17} are each independently hydrogen or a C_1 to C_4 alkyl:



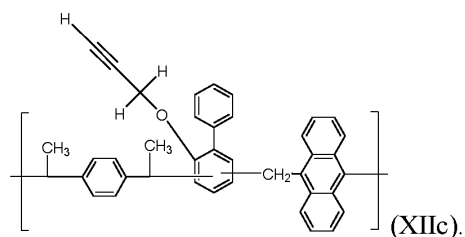
10. The composition of claim 9, wherein, fAr is a group comprising 2-8 fused aromatic rings.
11. The composition of claim 9 or 10, wherein, fAr is anthracene.
12. The composition of any one of claims 9 to 11, wherein, said repeat unit has structure (XIIa):



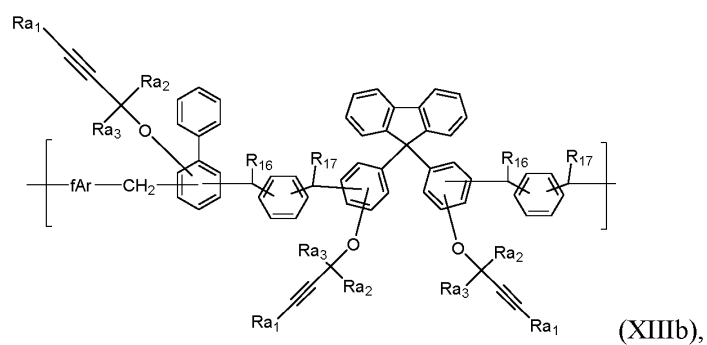
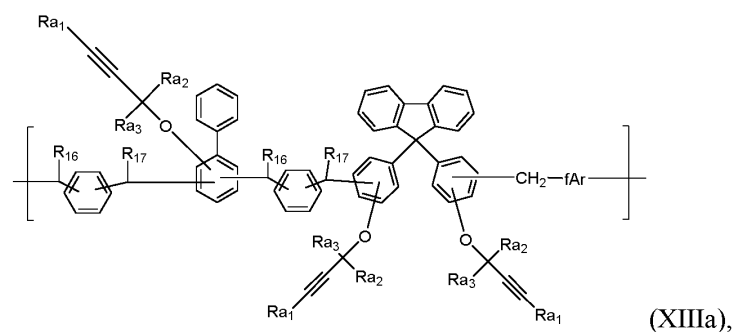
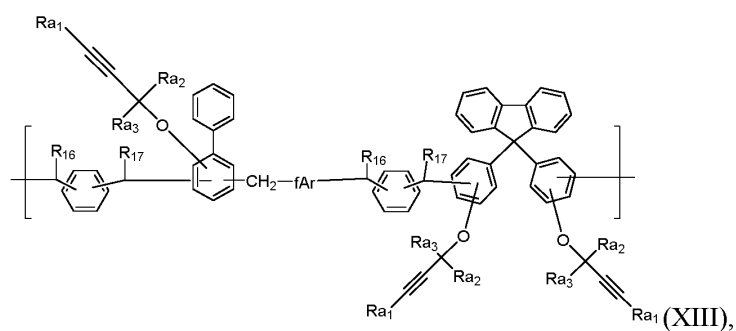
13. The composition of any one of claims 9 to 12, wherein, said repeat unit has structure (XIIb):

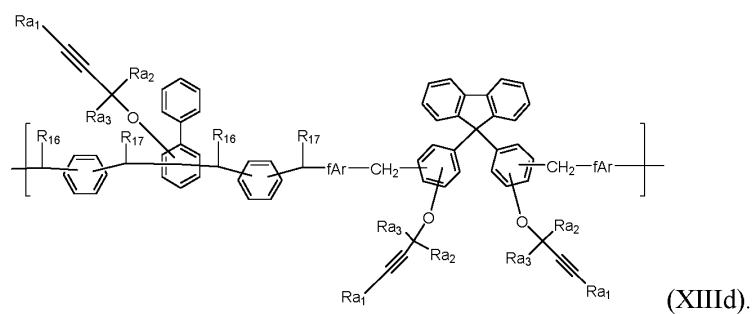
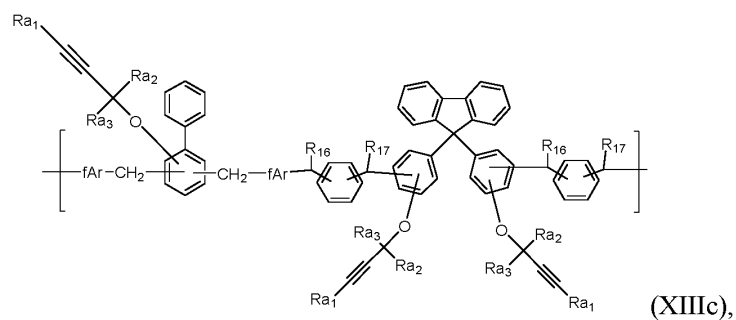


14. The composition of any one of claims 9 to 13, wherein, said repeat unit has structure (XIIC):

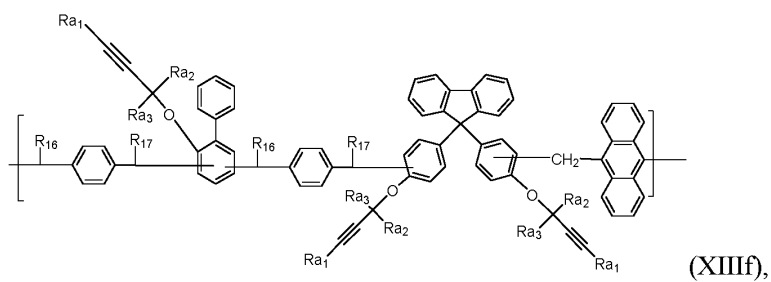
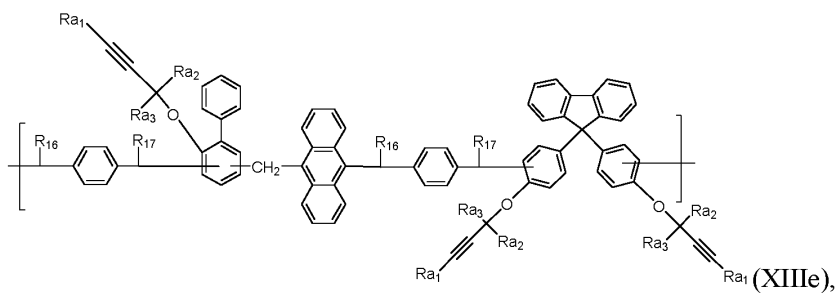


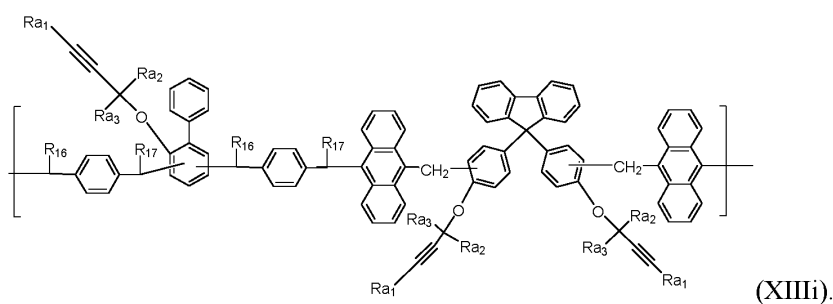
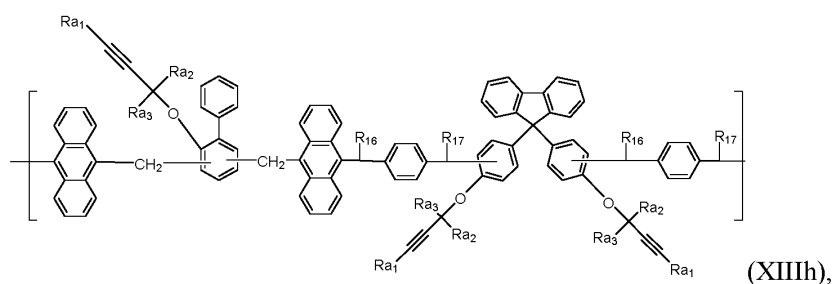
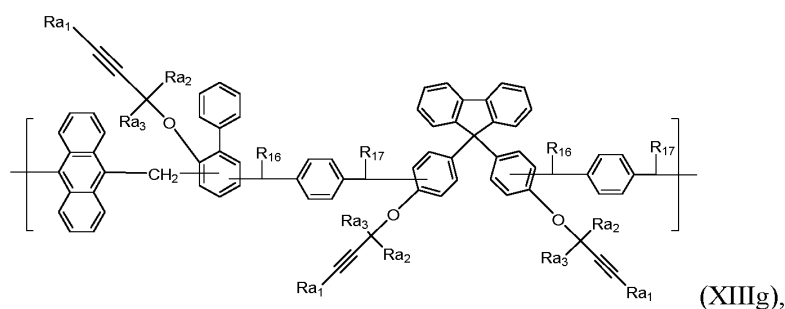
15. The composition of claim 1 or 2, wherein said spin on high carbon polymer comprising repeat units, selected from the group consisting of repeat units having structures (XIII), (XIIIa), (XIIIb), (XIIC), and (XIId), and mixtures thereof,



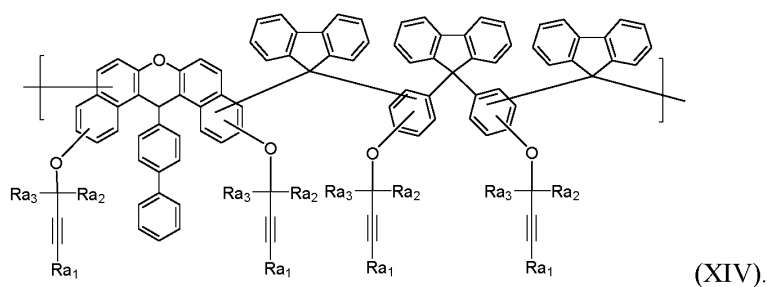


16. The composition of any one of claims 1, 2, and 15, wherein said spin on high carbon polymer comprising repeat units, selected from the group consisting of repeat units having structures (XIIIe), (XIIIg), (XIIIh), and (XIIIi), and mixtures thereof,

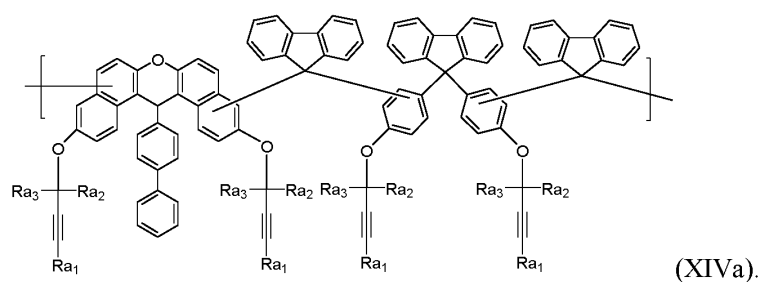




17. The composition of any one of claims 1, 2, 15, and 16, wherein R_{16} and R_{17} are a C_1 to C_6 alkyl.
18. The composition of any one of claims 1, 2, 15, 16, and 17, wherein R_{16} and R_{17} are an C_1 to C_4 alkyl.
19. The composition of any one of claims 1, 2, 15 and 16, wherein R_{16} and R_{17} are a hydrogen.
20. The composition of any one of claims 1, 2, 15 to 18, wherein R_{16} and R_{17} are methyl.
21. The composition of any one of claims 1, 2, 15 to 20, wherein Ra_1 , Ra_2 and Ra_3 are hydrogen.
22. The composition of any one of claims 1, 2, and 3 wherein said spin on high carbon polymer comprises repeat units, having structures (XIV),



23. The composition of any one of claims 1, 2, 3, and 22, wherein said spin on high carbon polymer comprises repeat units, having structures (XIVa),



24. The composition of any one of claims 1, 2, 3, 22, and 23, wherein, Ra₁, Ra₂ and Ra₃ are hydrogen.

25. The composition of any one of claims 1 to 24, wherein, M is selected from the group consisting of Zr, Ta, Hf, Ti, Sn, Si, Pb, Nb, Mo, Ge and W.

26. The composition of any one of claims 1 to 25, wherein, M is selected from the group consisting of Zr, Hf, Ti, Ta, Nb, and Sn.

27. The composition of any one of claims 1 to 26, wherein, component a), is a mixture of two or more different metal compounds having structure (I).

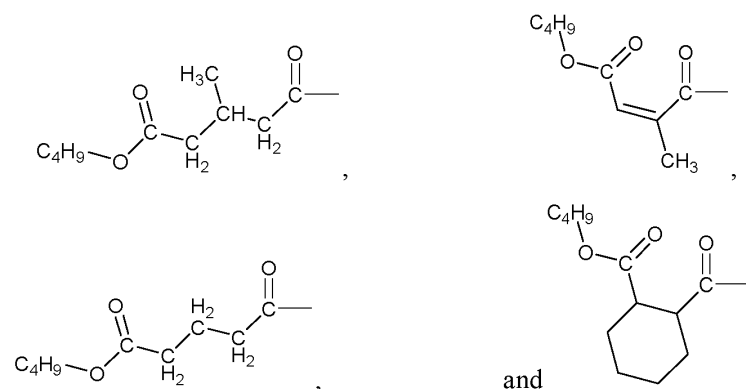
28. The composition of claim 27, wherein, the mixture of two or more different metal compounds having structure (I) have different M's.

29. The composition of any one of claims 27 to 28, wherein, at least one metal compound in the mixture does not have M equal to Si.

30. The composition of any one of claims 1 to 29, wherein, component a), is a mixture of two different metal compounds, having structure (I), a first metal compound and a second metal compound, wherein, the first metal compound's M is Si and the second metal compound has M selected from the group consisting of Zr, Ta, Hf, Ti, Sn, Pb, Nb, Mo, Ge and W.

31. The composition of any one of claims 1 to 30, wherein, at least one of R_1 , R_2 , R_3 and R_4 is selected from the group consisting of a first organic moiety having the structure (II) and a silicon bearing organic moiety having at least 2 carbons and having the structure (IV).

32. The composition of any one of claims 1 to 31, wherein, at least one of R_1 , R_2 , R_3 and R_4 is selected from the group consisting of:



33. The composition of any one of claims 1 to 31, wherein, each R_1 , R_2 , R_3 and R_4 is independently selected from the group consisting of a first organic moiety having the structure (II) and a silicon bearing organic moiety having at least 2 carbons and having the structure (IV).

34. The composition of any one of claims 1 to 33, wherein, the silicon bearing organic moiety having at least 2 carbons and having the structure (IV) is present in a range from 30 mole % to 60 mole % of the total moles of R_1 , R_2 , R_3 and R_4 of the metal compound having the structure (I).

35. The composition of any one of claims 1 to 34, wherein, n is 2 to 20.

36. The composition of any one of claims 1 to 34, wherein, n is 1.

37. The composition of any one of claims 1 to 36, wherein, R_5 is a C_2 to C_{10} alkylene.

38. The composition of any one of claims 1 to 36, wherein, R_5 is a C_2 to C_{10} alkylene containing a $C=C$ double bond.

39. The composition of any one of claims 1 to 36, wherein, R_5 is a C_5 to C_{12} cycloalkylene.

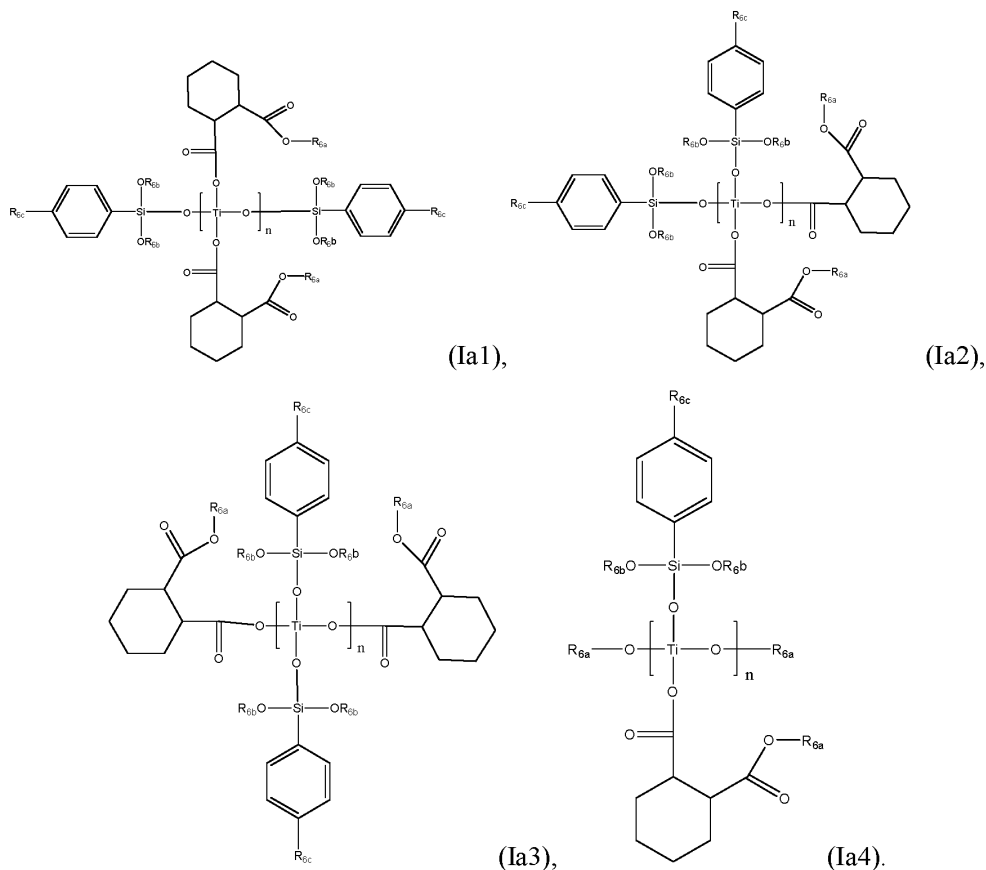
40. The composition of any one of claims 1 to 36, wherein, R_6 is a C_1 to C_8 alkyloxycarbonyl.

41. The composition of any one of claims 1 to 36, wherein, R_6 is a C_2 to C_6 alkyloxycarbonyl.

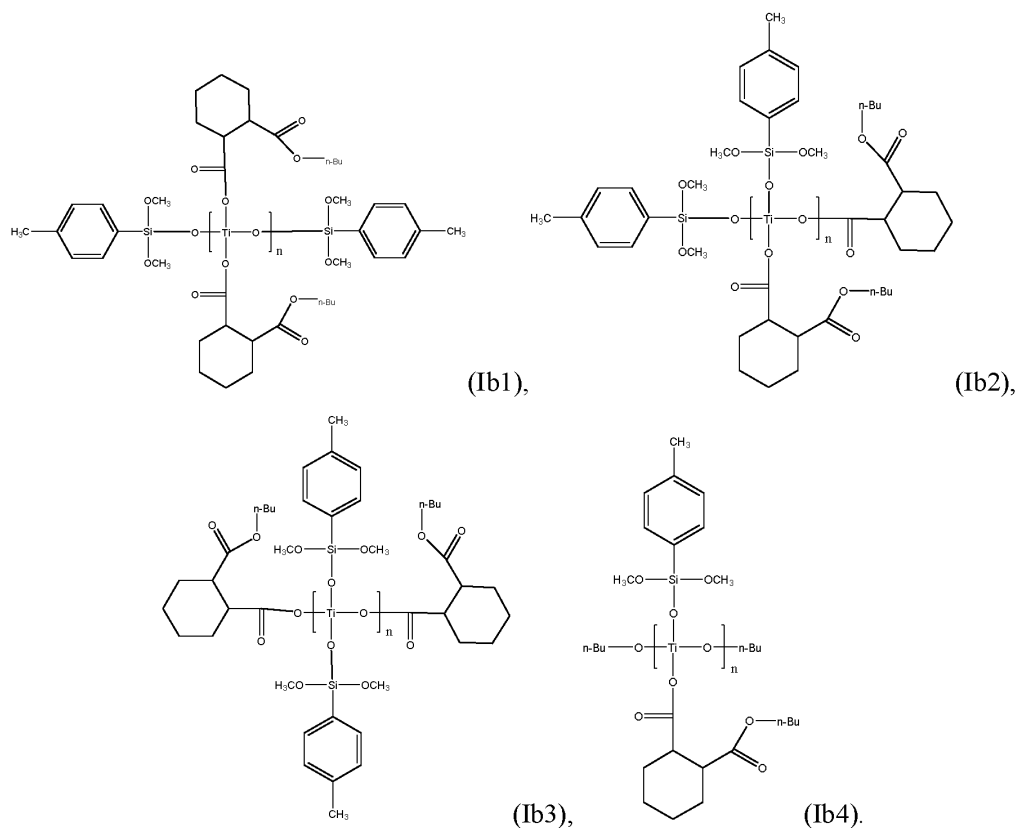
42. The composition of any one of claims 1 to 36, wherein, R_6 is a C_3 to C_4 alkyloxycarbonyl.

43. The composition of any one of claims 1 to 36, wherein, R₇ is a C₁ to C₈ alkyl.
44. The composition of any one of claims 1 to 36, wherein, R₇ is a C₂ to C₆ alkyl.
45. The composition of any one of claims 1 to 36, wherein, R₇ is C₃ to C₄ alkyl.
46. The composition of any one of claims 1 to 36, wherein, R₈ is methyl, ethyl, propyl, butyl or t-butyl.
47. The composition of any one of claims 1 to 36, wherein, R₈ is selected from the group consisting of C₁ to C₈ alkyloxys, C₃ to C₁₂ branched alkyloxys, and C₆ to C₁₆ aryls.
48. The composition of any one of claims 1 to 36, wherein, R₉ is methyl, ethyl, propyl, butyl or t-butyl.
49. The composition of any one of claims 1 to 36, wherein R₉ is selected from the group consisting of C₁ to C₈ alkyloxys, C₃ to C₁₂ branched alkyloxys, and C₆ to C₁₆ aryls.
50. The composition of any one of claims 1 to 36, wherein R₁₀ is a siloxane having the structure (V).
51. The composition of any one of claims 1 to 36, wherein R₈ and R₉ are independently selected from the group consisting of C₁ to C₈ alkyloxys, C₃ to C₁₂ branched alkyloxys, and C₆ to C₁₆ aryls; and R₁₀ is a siloxane having the structure (V), wherein, R₁₁ is a silyl moiety having structure (IVa) wherein, R_{8a} and R_{9a} are each independently selected from C₁ to C₈ alkyloxys, C₃ to C₁₂ branched alkyloxys, and R_{10a} is a C₆ to C₁₆ aryl and R₁₂ and R₁₃ are each independently selected from the group consisting of C₁ to C₈ alkyls.
52. The composition of any one of claims 1 to 36, wherein R₈ and R₉ are independently selected from the group consisting of C₁ to C₈ alkyloxys, C₃ to C₁₂ branched alkyloxys, and C₆ to C₁₆ aryls; and wherein, R₁₀ is selected from the group consisting of C₁ to C₈ alkyls, C₃ to C₁₂ branched alkyls, C₁ to C₈ alkyloxys, C₃ to C₁₂ branched alkyloxys, and C₆ to C₁₆ aryls.
53. The composition of any one of claims 1 to 36, wherein, R₁₀ is methyl, ethyl, propyl, butyl or t-butyl.
54. The composition of any one of claims 1 to 36, wherein, R₁₀ is a C₁ to C₈ alkyl.
55. The composition of any one of claims 1 to 36, wherein, R₁₁ is a C₁ to C₈ alkyl or hydrogen.
56. The composition of any one of claims 1 to 36, wherein, R₁₁ is a C₁ to C₄ alkyl or hydrogen.
57. The composition of any one of claims 1 to 36, wherein, R₁₁ is a C₁ to C₈ alkyl.
58. The composition of any one of claims 1 to 36, wherein, R₁₁ is a C₁ to C₄ alkyl.

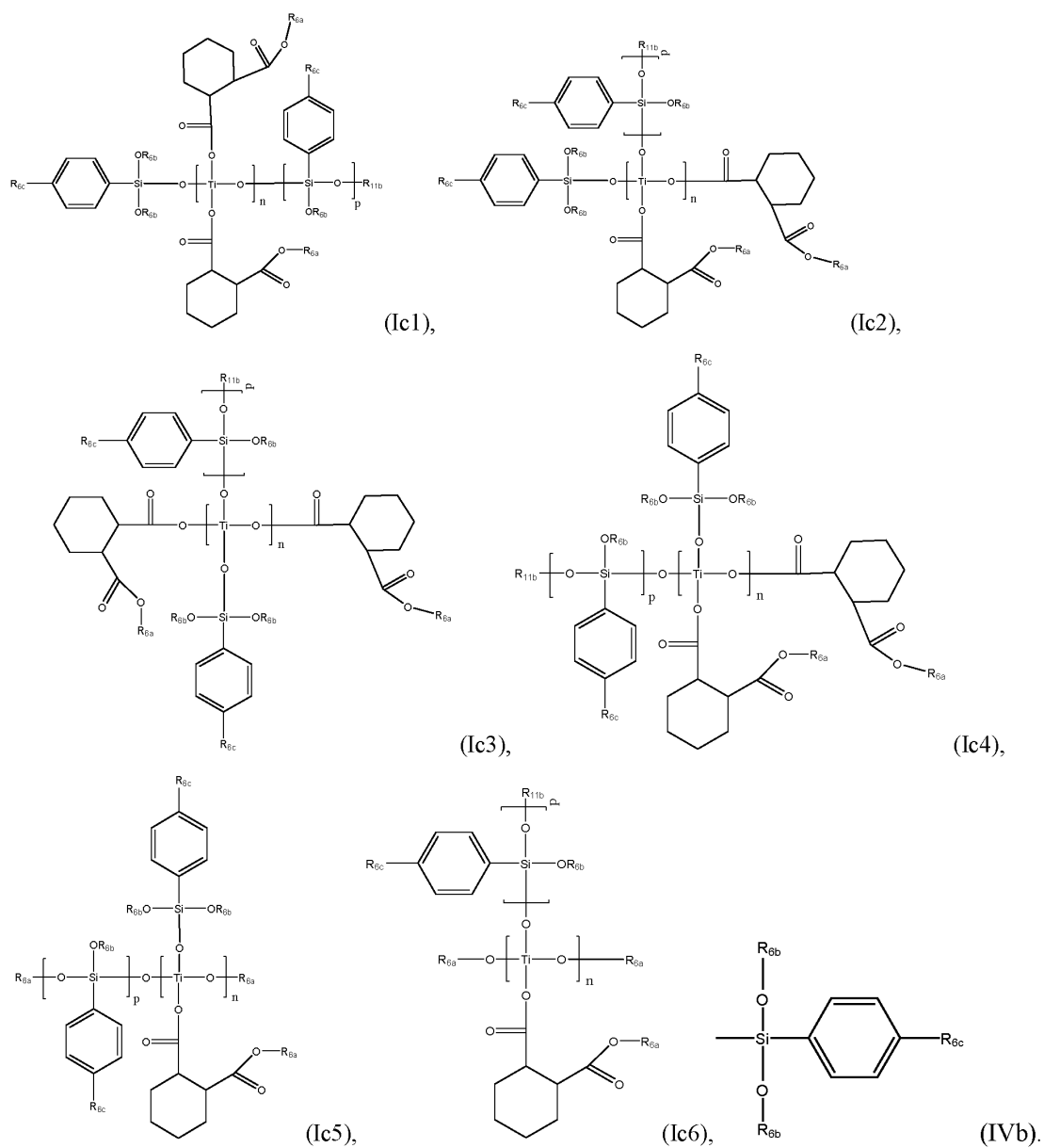
59. The composition of any one of claims 1 to 36, wherein, R_{11} is hydrogen.
60. The composition of any one of claims 1 to 36, wherein, R_{12} is a C_1 to C_8 alkyl.
61. The composition of any one of claims 1 to 36, wherein, R_{12} is a C_1 to C_6 alkyl.
62. The composition of any one of claims 1 to 36, wherein R_{12} is a C_1 to C_4 alkyl.
63. The composition of any one of claims 1 to 36, wherein R_{13} is a C_1 to C_8 alkyl.
64. The composition of any one of claims 1 to 36, wherein R_{13} is a C_1 to C_6 alkyl.
65. The composition of any one of claims 1 to 36, wherein R_{13} is a C_1 to C_4 alkyl.
66. The composition of any one of claims 1 to 36, wherein p is 1-500
67. The composition of any one of claims 1 to 36, wherein p is 1-200.
68. The composition of any one of claims 1 to 36, wherein p is 1-50.
69. The composition of any one of claims 1 to 24, comprising metal compounds having any one the following structures or mixtures of these compounds, wherein, R_{6a} , R_{6b} and R_{6c} are independently selected from C_1 to C_4 alkyls, and further wherein, n independently is an integer from 1 to 20:



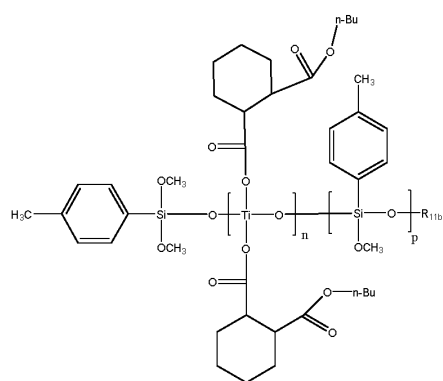
70. The composition of any one of claims 1 to 24, comprising a metal compound having any one the following structures or mixtures of these compounds, wherein, n independently is an integer from 1 to 20:



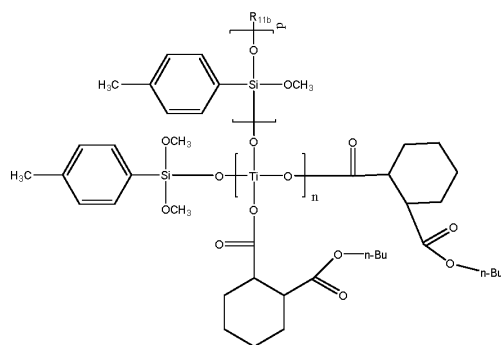
71. The composition of any one of claims 1 to 24, comprising a metal compound having any one the following structures or mixtures of these compounds, wherein, R_{11b} is selected from the group consisting of hydrogen, C₁ to C₈ alkyls, C₁ to C₈ alkyls substituted with a hydroxyl, a C₆ to C₁₆ aryl, and a silyl moiety having structure (IVb) R_{6a}, R_{6b} and R_{6c} are independently selected from C₁ to C₄ alkyls, and further wherein, n independently is an integer from 1 to 20, and p, independently, is an integer from 1 to 500:



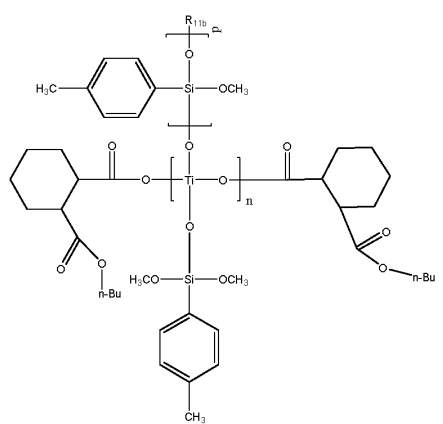
72. The composition of any one of claims 1 to 24, comprising a metal compound having any one the following structures or mixtures of these compounds, wherein, R_{11a} is a silyl moiety having structure (IVc), wherein, n is independently is an integer from 1 to 20 and p is independently an integer from 1 to 500:



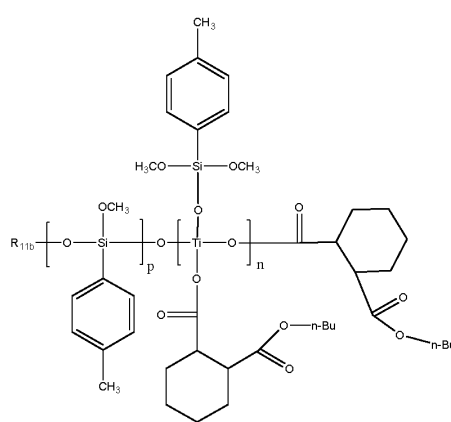
(Id1),



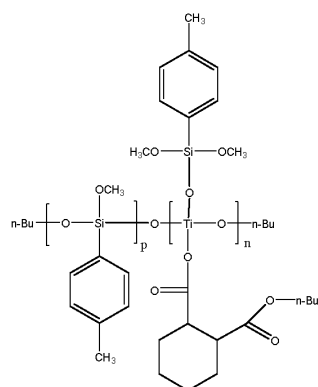
(Id2)



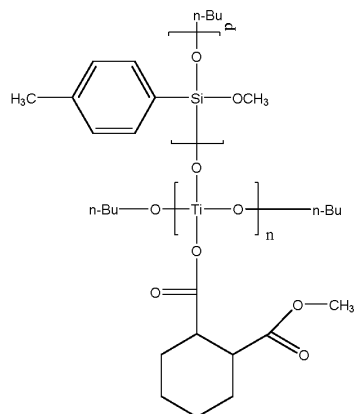
(Id3),



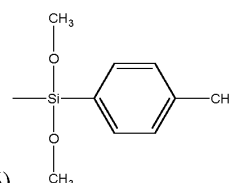
(Id4),



(Id5),

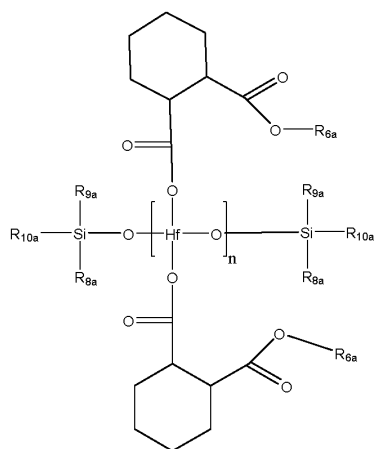


(Id6)

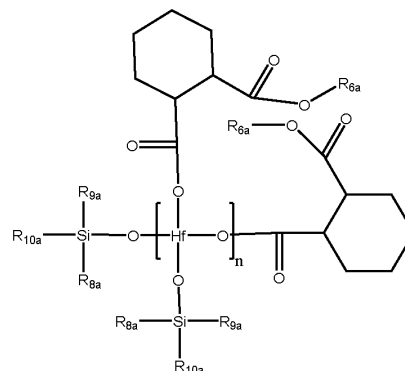


(IVc).

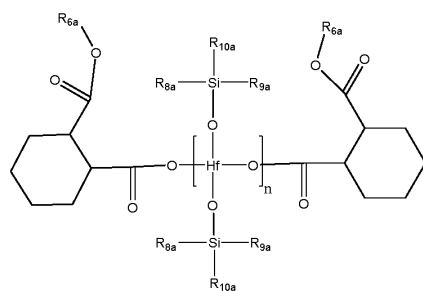
73. The composition of any one of claims 1 to 24, comprising a metal compounds having any one the following structures or mixtures of these compounds, wherein, n is independently an integer from 1 to 20:



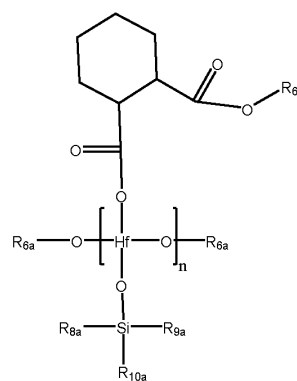
(Ie1),



(Ie2),

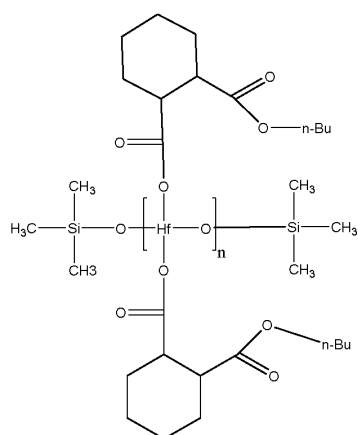


(Ie3),

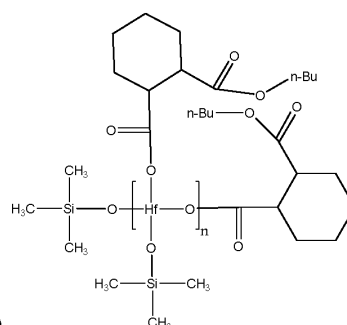


(Ie4).

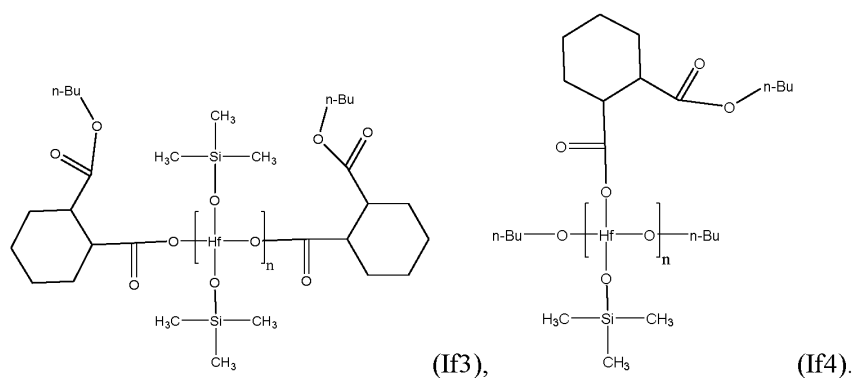
74. The composition of any one of claims 1 to 24, comprising metal compounds having any one the following structures or mixtures of these compounds, wherein, n is independently an integer from 1 to 20:



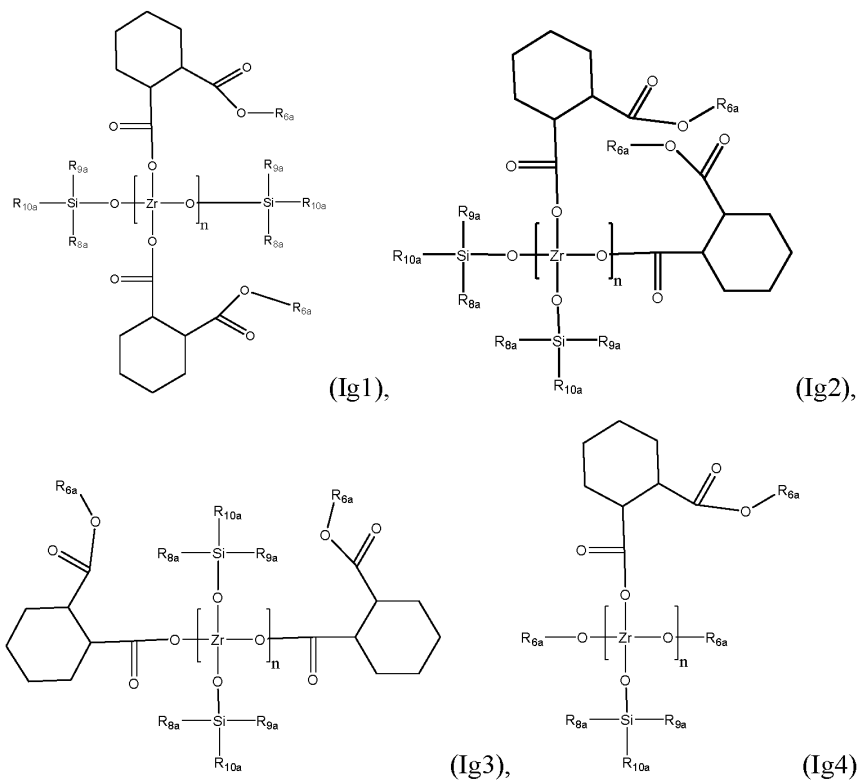
(If1),



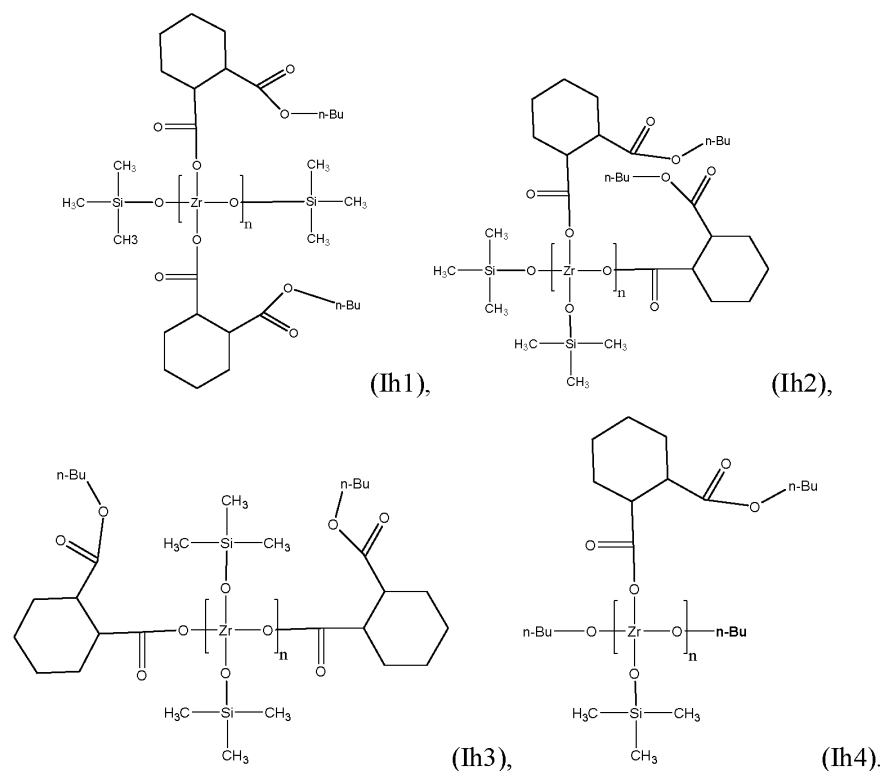
(If2),



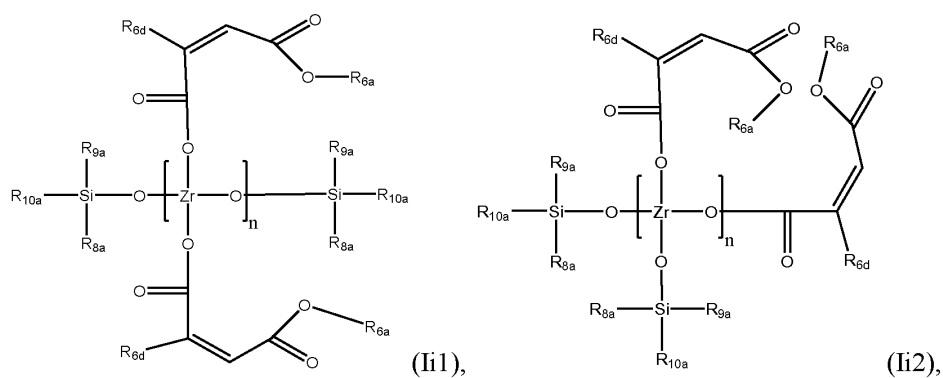
75. The composition of any one of claim 1 to 24, comprising metal compounds having any one the following structures or mixtures of these compounds, wherein, n is independently an integer from 1 to 20:

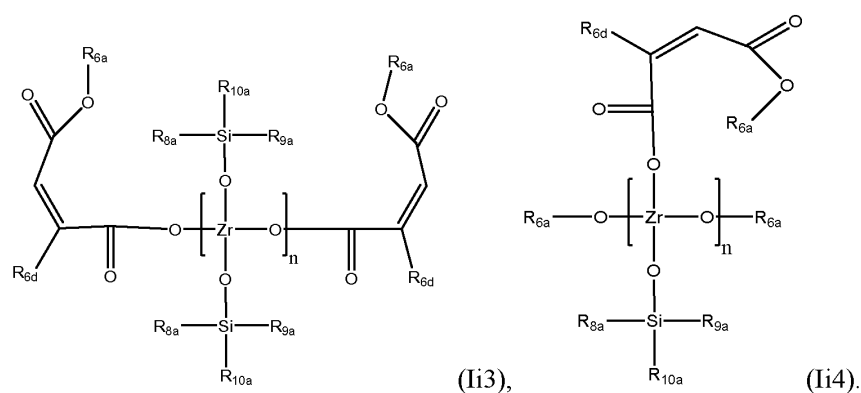


76. The composition of any one of claims 1 to 24, comprising metal compounds having any one the following structures or mixtures of these compounds, wherein, n is independently an integer from 1 to 20:

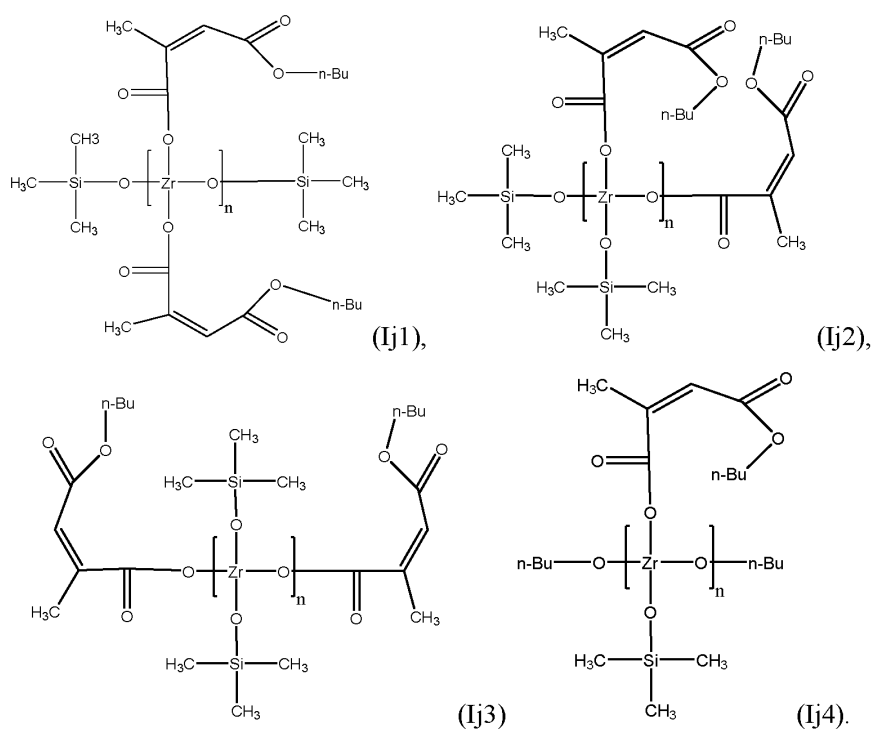


77. The composition of any one of claims 1 to 24, comprising metal compounds having any one the following structures or mixtures of these compounds, wherein, R_{6a} and R_{6d} are independently selected from C_1 to C_4 alkyls, and R_{8a} and R_{9a} are each independently selected from the group consisting of C_1 to C_8 alkyls, C_3 to C_{12} branched alkyls, C_1 to C_8 alkyloxys, C_3 to C_{12} branched alkyloxys, and C_6 to C_{16} aryls, and R_{10a} is selected from the group consisting of C_1 to C_8 alkyls, and C_6 to C_{16} aryls, wherein, n is independently an integer from 1 to 20:



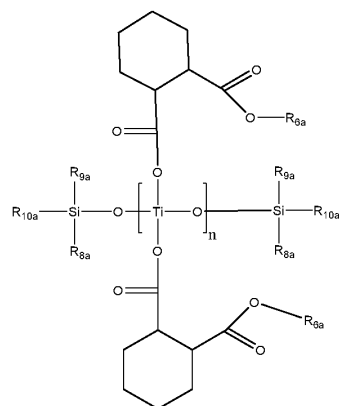


78. The composition of any one of claims 1 to 24, comprising metal compounds having any one the following structures or mixtures of these compounds, wherein, n is independently an integer from 1 to 20:

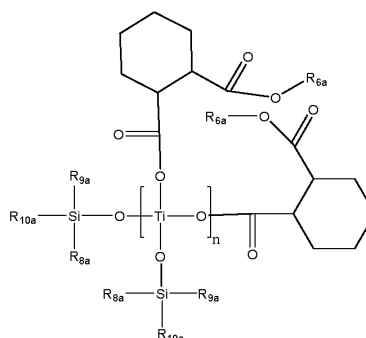


79. The composition of any one of claims 1 to 24, comprising metal compounds having any one the following structures or mixtures of these compounds, wherein, R_{6a} is selected from C_1 to C_4 alkyls, and R_{8a} and R_{9a} are each independently selected from the group consisting of C_1 to C_8 alkyls, C_3 to C_{12} branched alkyls, C_1 to C_8 alkyloxys, C_3 to C_{12} branched alkyloxys, and C_6 to C_{16} aryls, and R_{10a} is selected

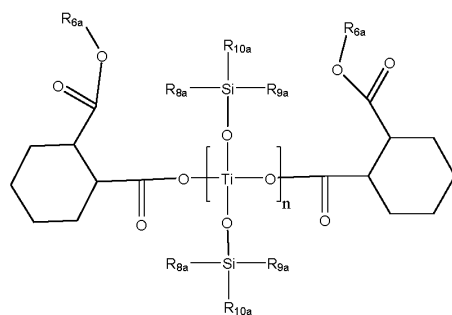
from the group consisting of C₁ to C₈ alkyls, and C₆ to C₁₆ aryls, n is independently an integer from 6 to 20:



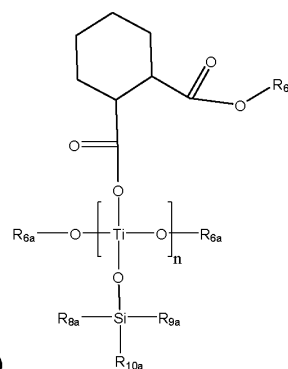
(Ik1),



(Ik2),

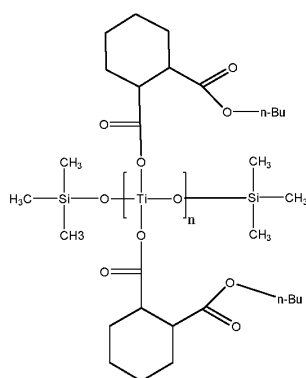


(Ik3),

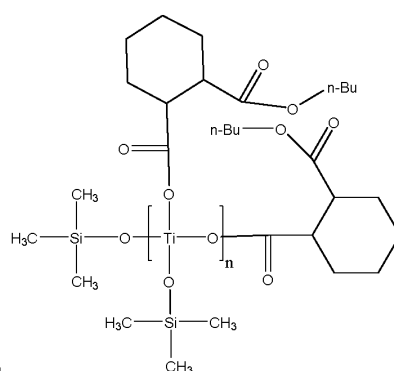


(Ik4).

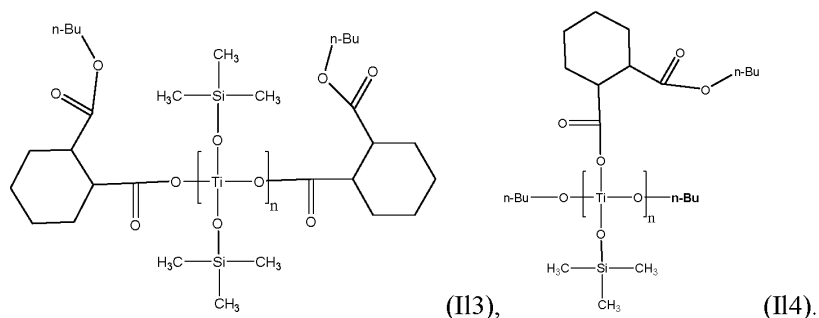
80. The composition of any one of claims 1 to 24, comprising metal compounds having any one the following structures or mixtures of these compounds, wherein n is independently an integer from 1 to 20:



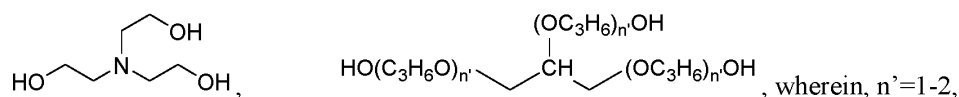
(II1),

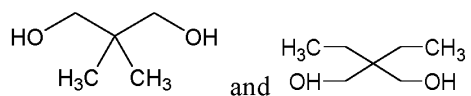
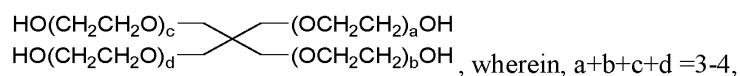


(II2),



81. The composition of any one of claims 1 to 80, wherein, in component c), in the polyol additive having the structure (VI), X is C.
82. The composition of any one of claims 1 to 80, wherein, in component c), in the polyol additive having the structure (VI), X is N.
83. The composition of any one of claims 1 to 80, wherein, in component c), in the polyol additive having the structure (VI), Y is a direct bond, methylene, ethylene or a moiety having the structure (VII).
84. The composition of any one of claims 1 to 80, wherein, r is 2, 3 or 4.
85. The composition of any one of claims 1 to 80, wherein R_{14} is hydrogen.
86. The composition of any one of claims 1 to 80, wherein the polyol additive having the structure (VI), is one wherein, q is 0, 1 or 2.
87. The composition of any one of claims 1 to 80, wherein the polyol additive having the structure (VI), wherein Y is structure (VII), is one wherein s is 0 or 2.
88. The composition of any one of claims 1 to 80, wherein the polyol additive having the structure (VI), wherein Y is structure (VII) is one wherein, R_{15} is ethylene or propylene.
89. The composition of any one of claims 1 to 80, wherein the polyol additive having the structure (VI), wherein Y is structure (VII), is one wherein, t is 1.
90. The composition of any one of claims 1 to 80, wherein, the polyol additive is selected from the group consisting of tetraethylene glycol, triethylene glycol, glycerol, triethanolamine, diethanolamine, neopentyl glycol, glycerol propoxylate, and pentaerythritol ethoxylate.
91. The composition of any one of claims 1 to 80, wherein, the polyol additive is selected from the group consisting of:





92. The composition of any one of claims 1 to 80, wherein, the polyol additive has a molecular weight of less than 500.
93. The composition of any one of claims 1 to 80, wherein, the polyol additive has a molecular weight of less than 300.
94. The composition of any one of claims 1 to 80, wherein, the polyol additive has a boiling point of at least 200°C.
95. The composition of any one of claims 1 to 80, wherein, the polyol additive has a boiling point of at least 250°C.
96. The composition of any one of claims 1 to 80, wherein, the polyol additive has a boiling point of at least 400°C.
97. The composition of any one of claims 1 to 96, wherein, the solvent is selected from the group consisting of alcohols, esters, ketones, lactones, diketones, aromatic moieties, carboxylic acids, amides and mixtures thereof.
98. The composition of any one of claims 1 to 97, wherein, the composition further comprises at least one additional component selected from the group consisting of surfactants, levelling agents, crosslinking additives and thermally activated catalysts.
99. The composition of claim 98, wherein, the surfactant is present in an amount that is less than 1% of the total weight of the composition.
100. A process of manufacturing an electronic device comprising:
- a) applying a composition of any one of claims 1 to 99, onto a substrate to form a coating film; and
 - b) heating the coating film at a temperature between 150°C and 400°C and for a time from 30 to 240 seconds, thereby forming a cured coating film.
101. The process of claim 100, wherein, said coating film is heated for a time of up to 120 seconds.
102. The process of claim 100 or 101, wherein, said composition is applied onto the substrate in step a) to form the coating film, by a spin-on coating process.

103. The process of claim 102, wherein, said composition is applied onto the substrate by a one-step spin-on coating.

104. The process according to any one of claims 100 to 103, wherein, the substrate is a patterned substrate comprising topographical features, and wherein, in step a) said coating film and in step b) said cured coating film overlays said topography, and further wherein, after step b), the process further comprises the step c):

c) removing the portion of said cured coating film overlaying the top of the topography using a chemical stripper or a fluorinated plasma etch, thereby producing filled topographical features wherein the cured coating film is flush with the top of said topographical features.

105. The process according to claim 104 wherein, said topographical features are formed by a patterned spin on organic high carbon coating or a patterned photoresist coating, overlying a silicon substrate.

106. The process according to claims 104 or 105, wherein said topographical features are Vias.

107. The process according to any one of claims 104 to 106, wherein the process further comprises, after step c), the following step d):

d) removing said patterned organic high carbon coating or said patterned photoresist with an oxygen plasma, thereby forming a negative tone image of said patterned photoresist or said patterned organic high carbon coating, wherein, the remaining said filled topographic features, after removal of said patterned photoresist or said patterned organic high carbon coating, forms a pattern comprised of metal oxide.

108. The process according to any one of claims 104 to 106, wherein, the process further comprises after step d) step e):

e) using said pattern comprised of metal oxide as a patterned hard mask, plasma etch barrier, and etching into the semiconductor substrate with a fluorinated plasma.

109. The process according to any one of claims 104 to 108, wherein, said topographical features have an aspect ratio of 1:1 to 10:1.

110. The process according to any one of claims 104 to 109 wherein, said topographical features have an aspect ratio of 1 to 10 and may be selected from ones that range in critical dimension (CD) from 5 nm to 100 nm, preferably from 10 nm to 100 nm.

111. The process according to any one of claims 104 to 110 wherein, in step b) baking the film at a temperature from 250°C to 400°C, is done in two baking steps b1) and b2) wherein, baking

step b1) is done from 250°C to 275°C and baking step b2) is done from 300 °C to 400 °C, preferably from 350°C to 400°C.

112. The process according to claim 111 wherein, said baking step b1) is 200 °C to 250°C, and the baking step b2) is 350°C to 400°C.

113. The process according to claim 111 or 112, wherein, said baking step b1) is done for 30 seconds to 120 seconds and said baking step b2) is done for 60 to 120 seconds.

114. The process according to any one of claims 111 to 113 wherein, said baking step b1 is done for 60 seconds to 120 seconds and said baking step b2) is done for 90 seconds to 120 seconds.

115. The process according to any one of claims 111 to 114, wherein, the baking step b1) is done for 60 seconds to 120 seconds.

116. The process according to any one of claims 111 to 115 wherein, said baking step b2) is done for 90 seconds to 120 seconds.

117. A process of coating a hard mask composition on a silicon substrate comprising:

a3) applying a composition from any one of claims 1 to 99 onto said substrate to form a coating film,

b3) baking the coating film to form a hard mask film,

c3) coating a bottom antireflective coating on top of said hard mask film,

d3) coating a photoresist on top of said antireflective coating,

e3) patterning the photoresist forming a photoresist pattern,

f3) etching through said bottom antireflective coating not protected by said photoresist pattern down to the hard mask coating with a fluorinated plasma,

g3) etching through said hard mask film not protected by the bottom antireflective coating and said photoresist pattern down to the silicon substrate with a chlorine plasma producing a patterned hard mask film, and

h3) etching with a fluorinated plasma into the silicon substrate in those area not protected by said patterned hard mask film producing topographical features into the silicon features.

118. The process according to claim 117 wherein, in step b3) baking the film at a temperature from 150°C to 400°C is done in two baking steps b1') and b2') wherein, baking step b1') is done from 150°C to 250°C and baking step b2') is done from 300°C to 400°C.

119. The process according to claim 118 wherein, said baking step b1') is 200°C to 250°C and the baking step b2') is 350°C to 400°C.

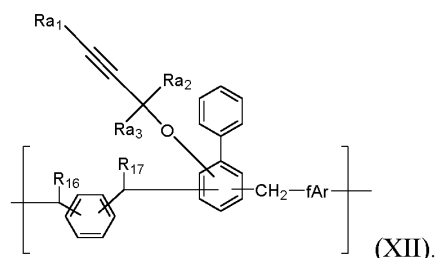
120. The process according to claims 118 or 119 wherein, said baking step b1') is done for 30 to 120 seconds and said baking step b2') is done for 60 seconds to 120 seconds.

121. The process according to any one of claims 118 to 120 wherein, said baking step b1') is done for 60 seconds and said baking step b2') is done for 90 seconds to 120 seconds.

122. The process according to any one of claims 118 to 121, wherein, said baking step b1') is done for 60 seconds to 120 seconds.

123. The process according to any one of claims 118 to 122, wherein, said baking step b2') is done for 90 seconds to 120 seconds.

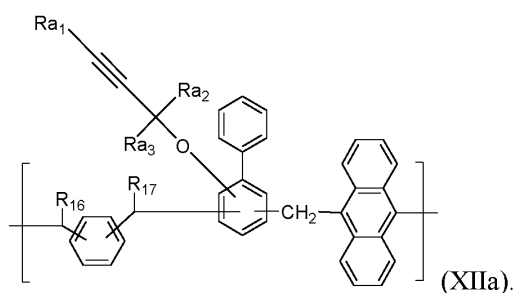
124. A spin on high carbon polymer comprising a repeat unit of structure (XII), wherein fAr is a fused aromatic ring, R₁₆ and R₁₇ are each independently hydrogen or a C₁ to C₄ alkyl;



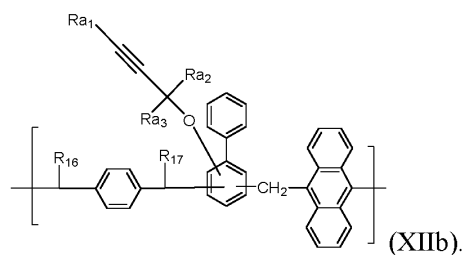
125. The spin on high carbon polymer of claim 124, wherein, fAr is a group comprising 2-8 fused aromatic rings.

126. The spin on high carbon polymer of claim 124, or 125 wherein, fAr is anthracene.

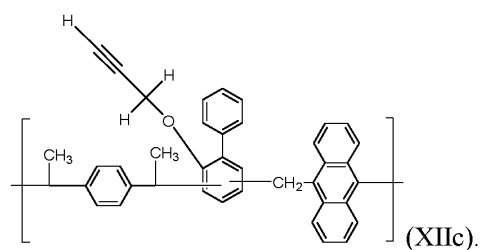
127. The spin on high carbon polymer of claim of any one of claims 124 to 126, wherein said repeat unit has structure (XIIa);



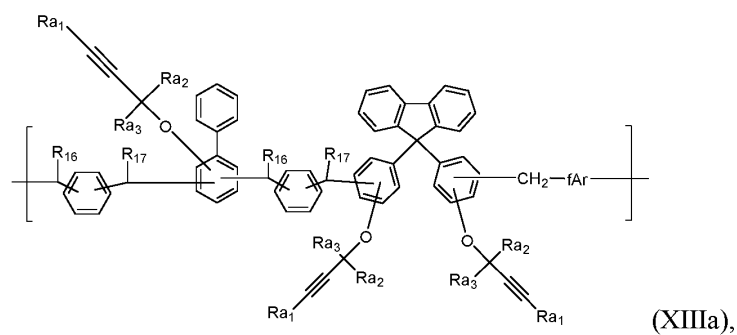
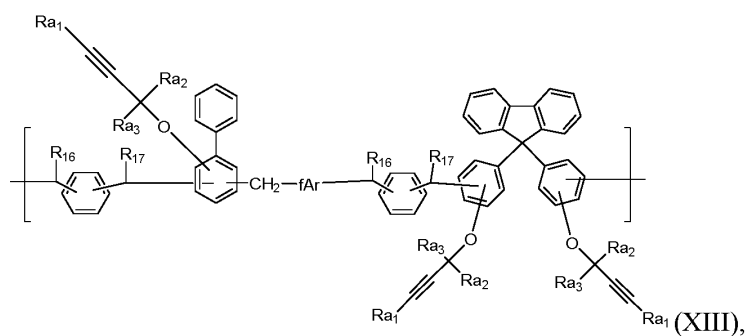
128. The spin on high carbon polymer of claim of any one of claims 124 to 127, wherein said repeat unit has structure (XIIb);

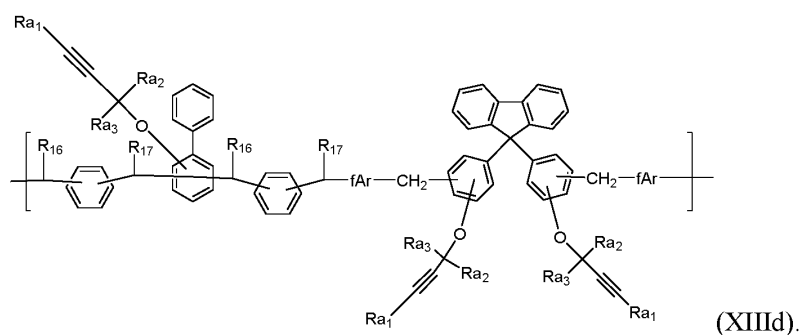
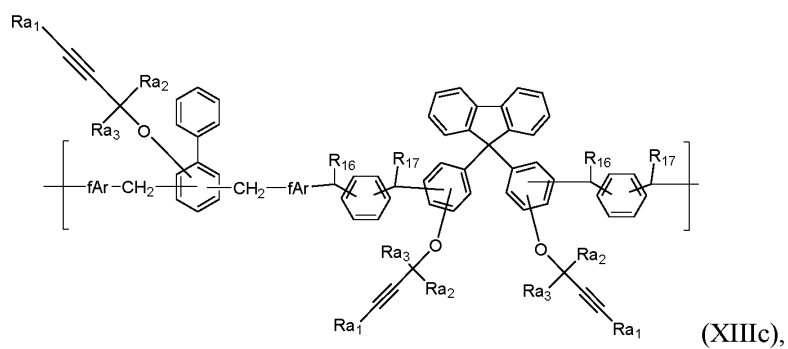
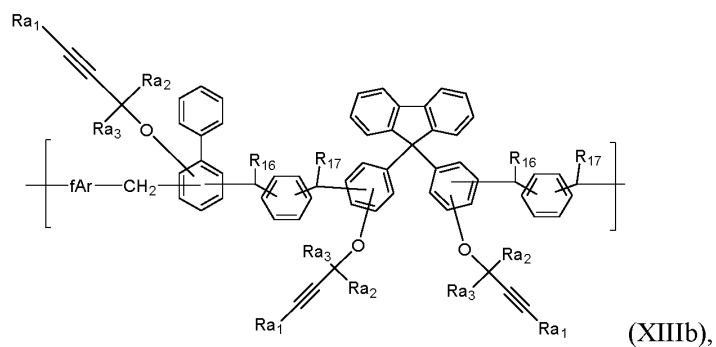


129. The spin on high carbon polymer of claim of any one of claims 124 to 128, wherein said repeat unit has structure (XIIc);

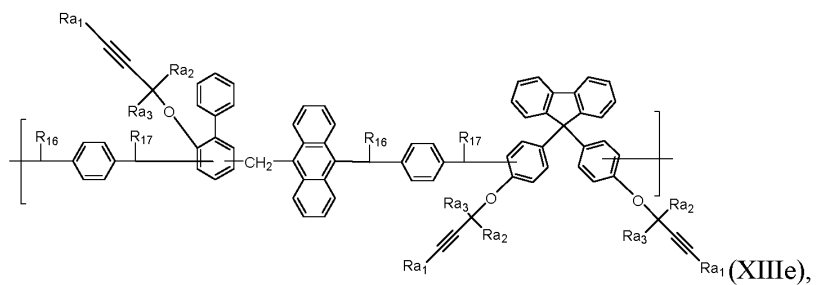


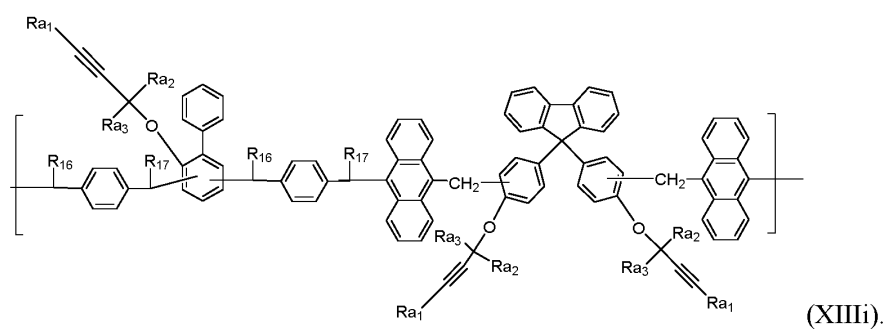
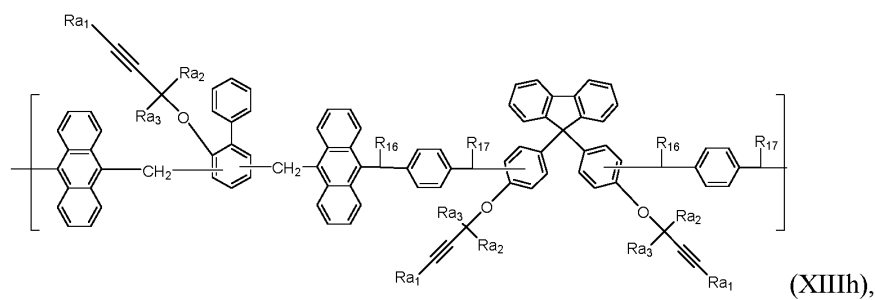
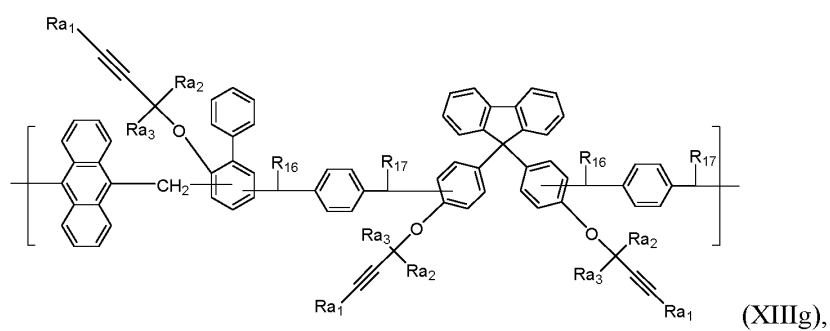
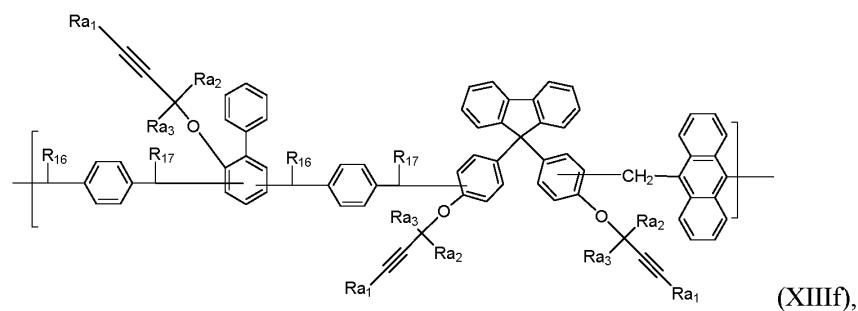
130. A spin on high carbon polymer comprising repeat units, selected from the group consisting of repeat units having structures (XIII), (XIIIa), (XIIIb), (XIIIc), and (XIIId), and mixtures thereof





131. The spin on high carbon polymer of claim 130 wherein said spin on high carbon polymer comprising repeat units, selected from the group consisting of repeat units having structures (XIIIe), (XIIIg), (XIIIh), and (XIIIi), and mixtures thereof,





132. The spin on high carbon polymer of claim 130 or 131, wherein R_{16} and R_{17} are a C_1 to C_6 alkyl.

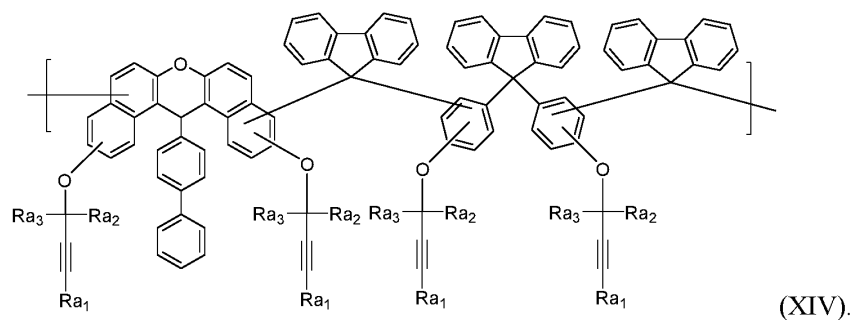
133. The spin on high carbon polymer of any one of claims 130 to 132 wherein R_{16} and R_{17} are an C_1 to C_4 alkyl.

134. The spin on high carbon polymer of any one of claims 130 to 131 wherein R_{16} and R_{17} are a hydrogen.

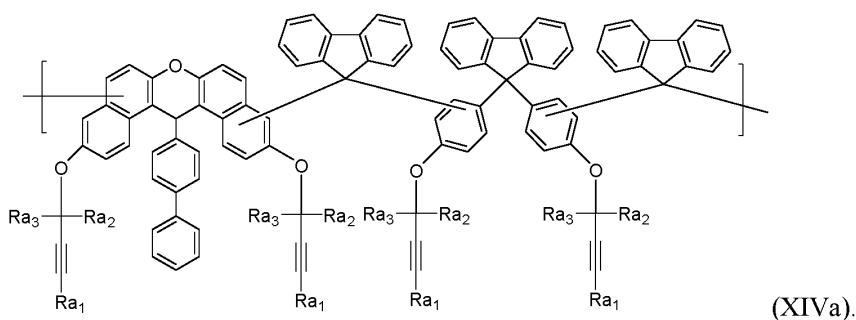
135. The spin on high carbon polymer of any one of claims 130 to 133 wherein R_{16} and R_{17} are methyl.

136. The spin on high carbon polymer of any one of claims 130 to 135 wherein R_{a1} , R_{a2} and R_{a3} are hydrogen.

137. A spin on high carbon polymer is a spin on high carbon polymer comprising repeat units having structures (XIV),



138. The spin on high carbon polymer of claim 137 comprising repeat units having structure (XIVa),



139. The spin on high carbon polymer of claim 137 or 138, wherein R_{a1} , R_{a2} and R_{a3} are hydrogen.

140. The use of the composition according to any one of claims 1 to 99 or of the spin on high carbon polymer of any one of claims 124 to 139 for forming a coating film on a substrate, preferably in the manufacture of an electronic device.