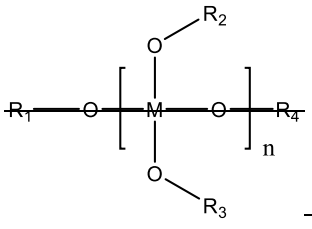
Claims

We claim:

1. A blend of components comprising:

a) 50 to 80 parts by weight of a metal compound having structure (I):



(I)

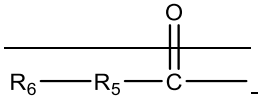
wherein,

M is a metal having a valence of four (4) selected from the group of Ti, Zr, Sn and Hf;

n is an integer from 1 to 20;

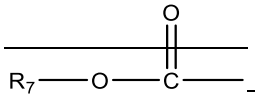
each R_1, R_2, R_3, and R_4 is independently selected from the group consisting of:

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



(II),

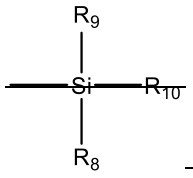
wherein, R_5 is selected from the group consisting of C_2 to C_{10} alkylenes, C_3 to C_{12} branched alkylenes, C_5 to C_{12} cycloalkylenes, C_2 to C_{10} alkylenes containing a C=C double bond, C_3 to C_{12} branched alkylenes containing a C=C double bond, and C_5 to C_{12} cycloalkylenes containing a C=C double bond; and R_6 is hydrogen or an alkyloxycarbonyl having structure (III),



(III),

wherein, R_7 is a C_1 to C_8 alkyl;

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

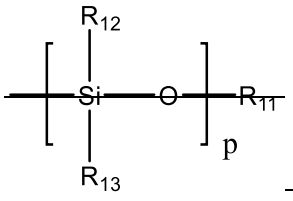


(IV),

wherein,

R_8 and R_9 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;

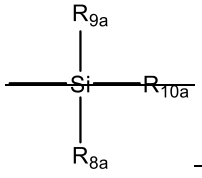
R_{10} is selected from the group consisting of C_1 to C_8 alkyls, C_6 to C_{16} aryls, hydroxyl and siloxanes having structure (V):



(V),

wherein,

R_{11} is selected from the group consisting of hydrogen, C_1 to C_8 alkyls, C_1 to C_8 alkyls substituted with a hydroxyl, a C_6 to C_{16} aryl, and a silyl moiety having structure (IVa) wherein, 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;



(IVa),

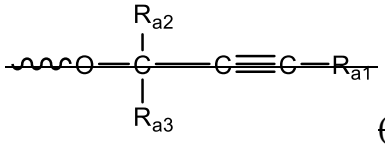
R_{12} and R_{13} are each independently selected from the group consisting of C_1 to C_8 alkyls, C_3 to C_{12} branched alkyls, C_1 to C_8 alkyloxys, C_3 to C_{12} branched alkyloxys, and C_6 to C_{16} aryls; and

p represents the number of repeat units in the siloxane moiety (V);

3) a second organic moiety selected from the group consisting of C_2 to C_8 alkyls, C_2 to C_8 alkyl carboxyls, C_6 to C_{20} aryl carboxyls, fluorenyl carboxyls, fluorinated C_2 to C_8 alkyl carboxyls, C_2 to C_8 alkyl sulfonyls, fluorinated C_2 to C_8 alkyl sufonyls, and mixtures thereof; and

4) mixtures thereof;

b) 40 to 50 parts by weight of 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 81 wt. % to 94 wt. %, which is soluble to at least 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),



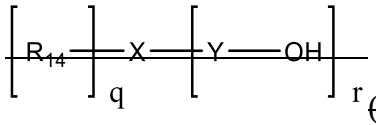
(VIII),

wherein,

~~~ 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) optionally up to 20 parts by weight of a polyol additive having structure (VI):



(VI),

wherein,

X is C or N;

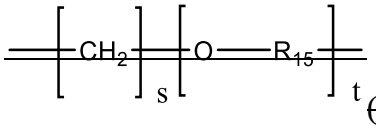
r is at least 2;

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 structure (VII):



(VII)

wherein,

R_{15} is a C_2 to C_8 alkylene;

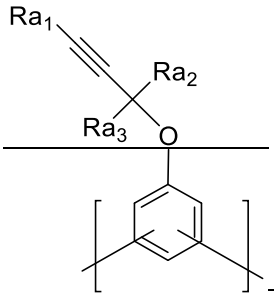
s is 0 to 2; and

t is 1 to 2;

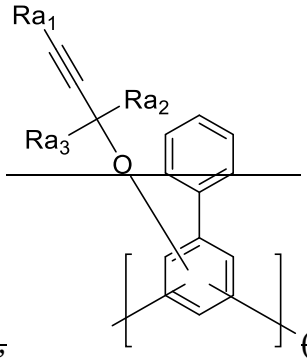
wherein a total of the components of the blend do not exceed 100 wt%; and

a spin casting solvent.

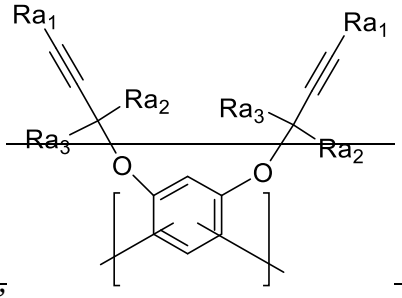
2. The composition according to claim 1, wherein said polymer backbone of said spin on high carbon polymer comprises moieties selected from the group consisting of
~~~



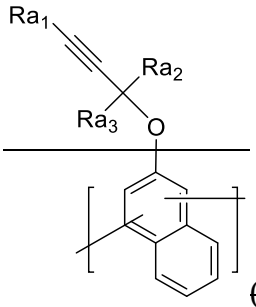
~~(IX),~~



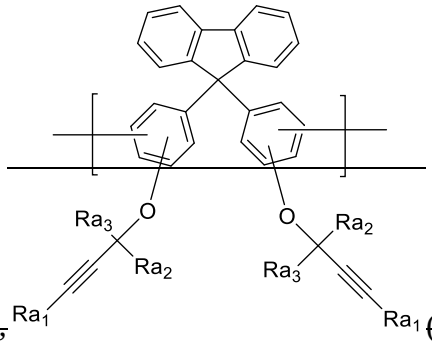
~~(IXa),~~



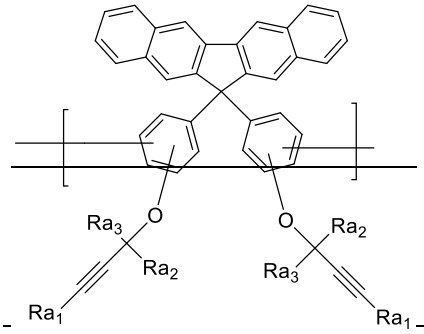
~~(IXb),~~



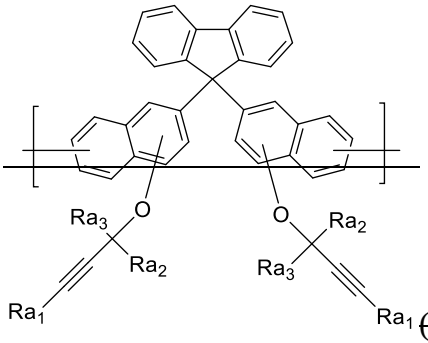
~~(IXc),~~



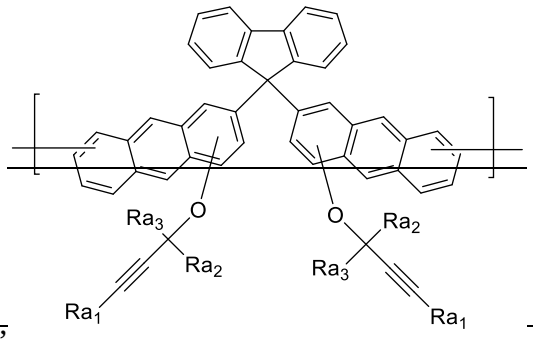
~~(IXd),~~



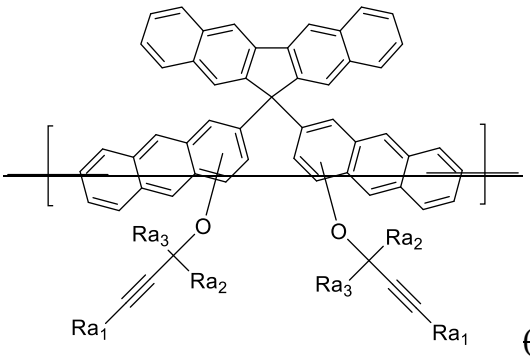
~~(IXe),~~

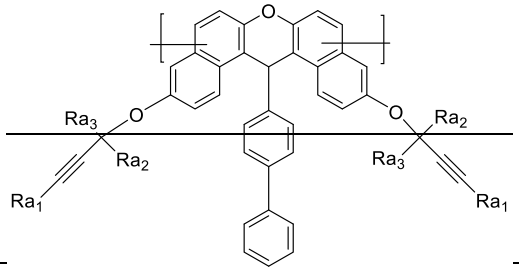


~~(IXf),~~



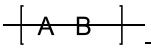
~~(IXg),~~



(IXh),


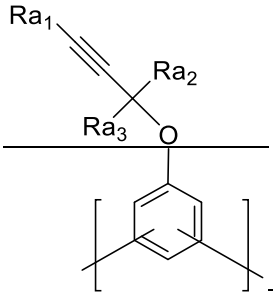
(IXi), and mixtures thereof.

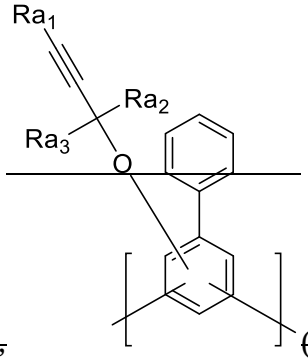
3. The composition of claim 1, wherein said spin on high carbon polymer comprises a repeat unit having structure (X),

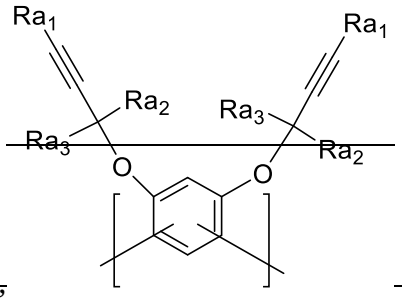


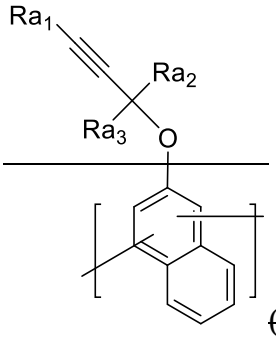
(X),

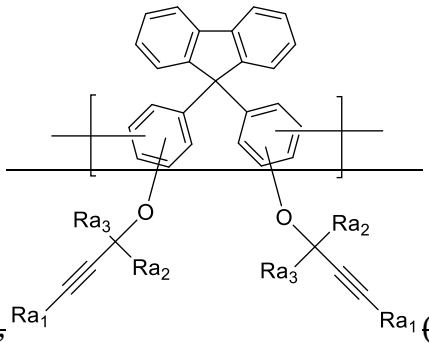
wherein A is selected from the group consisting of

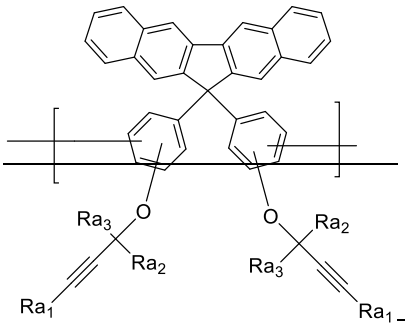


(IX),


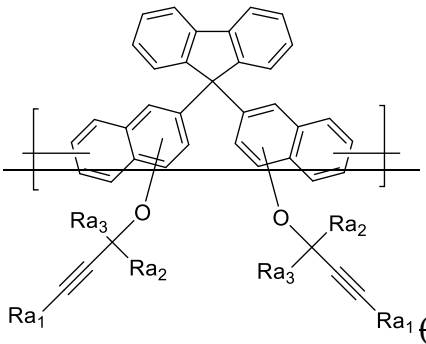
(IXa),


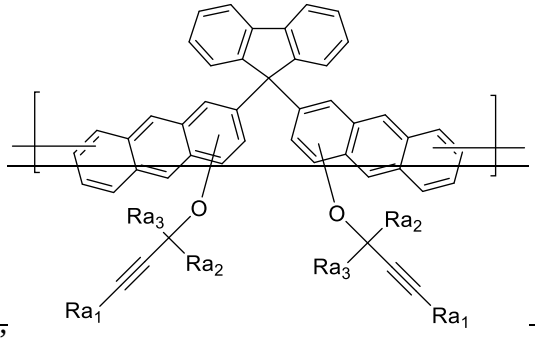
(IXb),


(IXc),


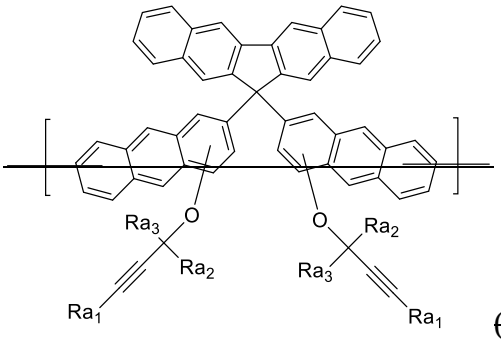
(IXd),


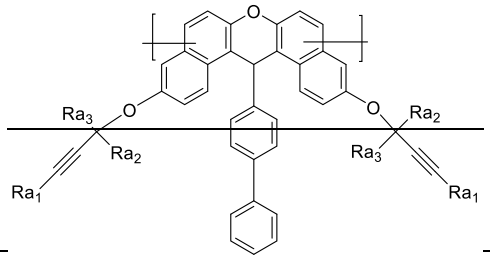
(IXe),



~~(IXf),~~ 

~~(IXg),~~

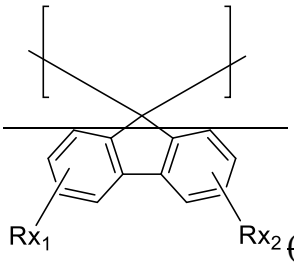


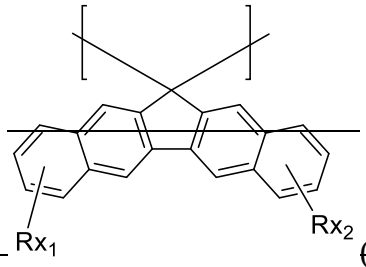
~~(IXh),~~ 

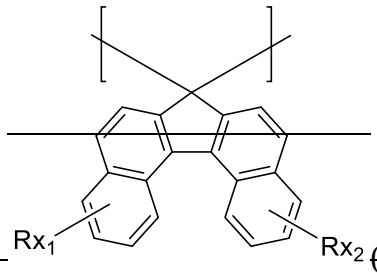
~~(IXi), and~~

~~mixtures thereof, and~~

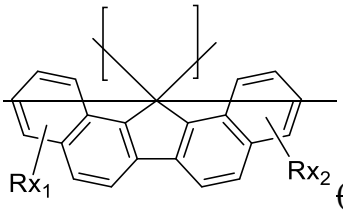
~~wherein B is selected from the group consisting of~~



~~(Xa),~~ 

~~(Xb),~~ 

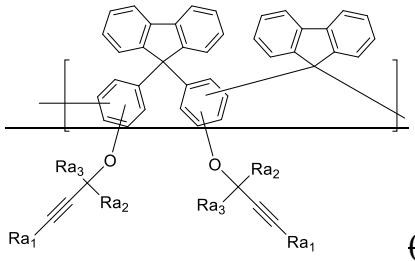
~~(Xc),~~



~~(Xd), and mixtures thereof,~~

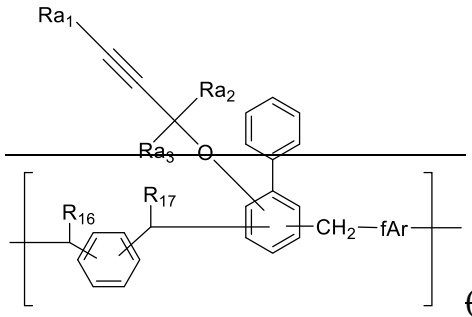
~~wherein Rx_1 and Rx_2 are independently hydrogen, a C_1 to C_6 alkyl, an aryl moiety, or an alkynyloxy moiety of structure (VIII).~~

~~4. The composition of claim 1, wherein said spin on high carbon polymer comprises a repeat unit having structure (XI);~~



~~(XI).~~

~~5. The composition of claim 1, 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:~~

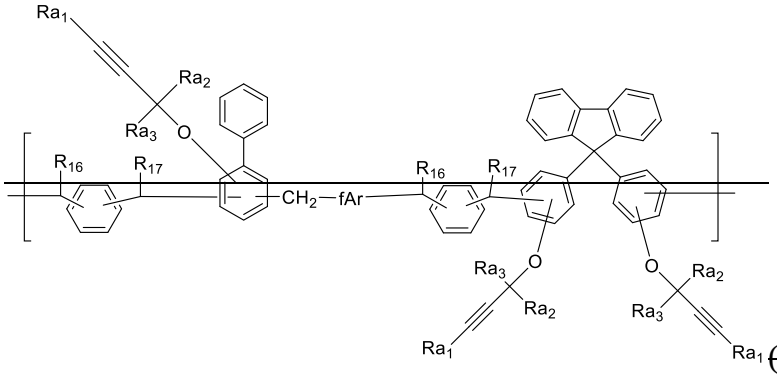


~~(XII).~~

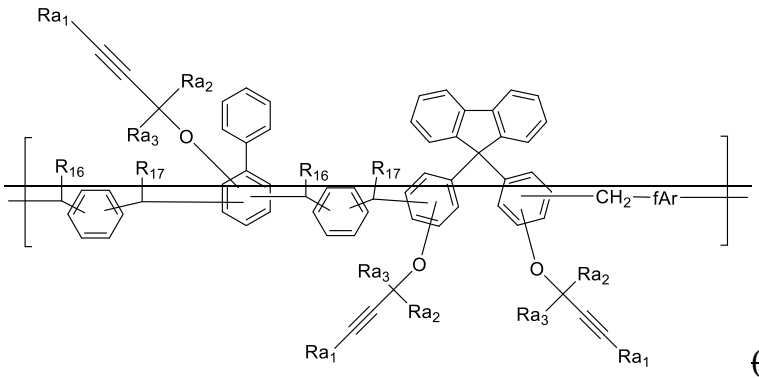
~~6. The composition of claim 5, wherein fAr is a group comprising 2-8 fused aromatic rings.~~

~~7. The composition of claim 5, wherein, fAr is anthracene.~~

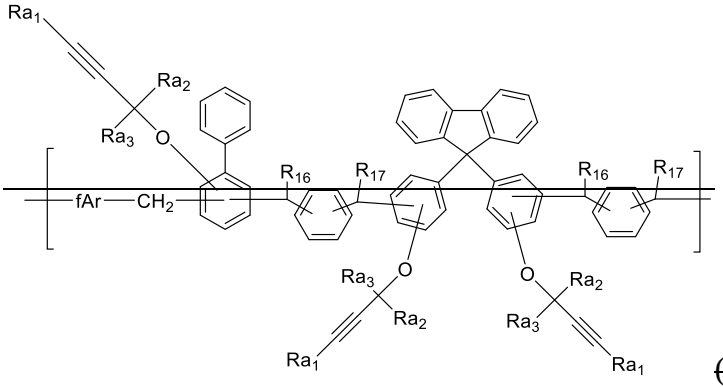
~~8. The composition of claim 1, wherein said spin on high carbon polymer comprising repeat units, selected from the group consisting of repeat units having structures (XIII), (XIIIa), (XIIIb), (XIIIc), and (XIIId), and mixtures thereof,~~



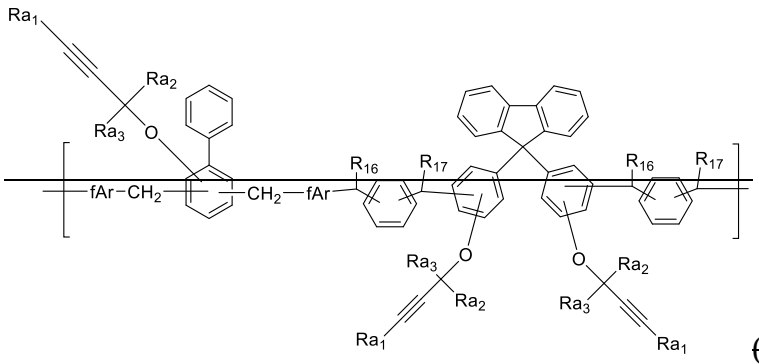
~~(XIII),~~



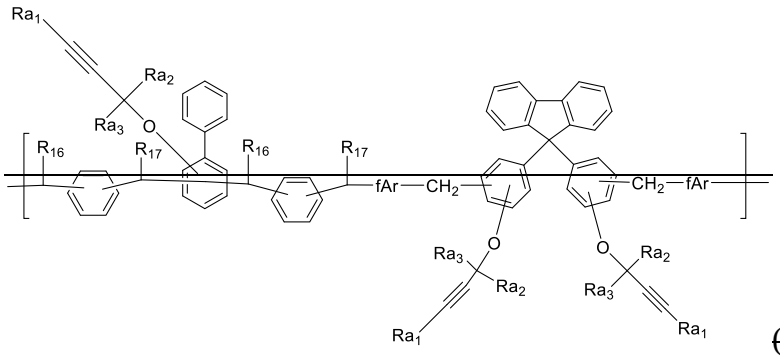
~~(XIIIa),~~



~~(XIIIb),~~

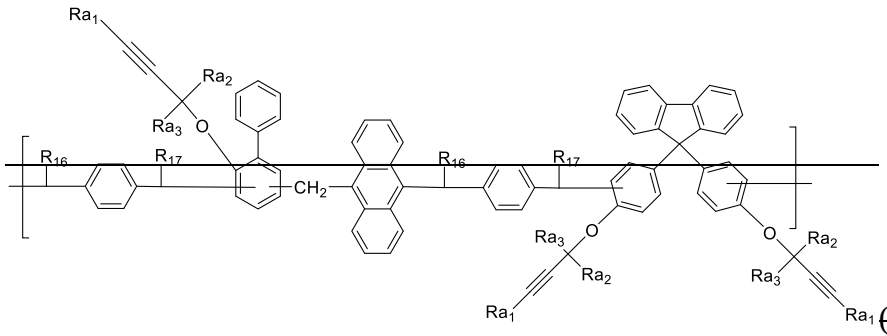


~~(XIIIc),~~

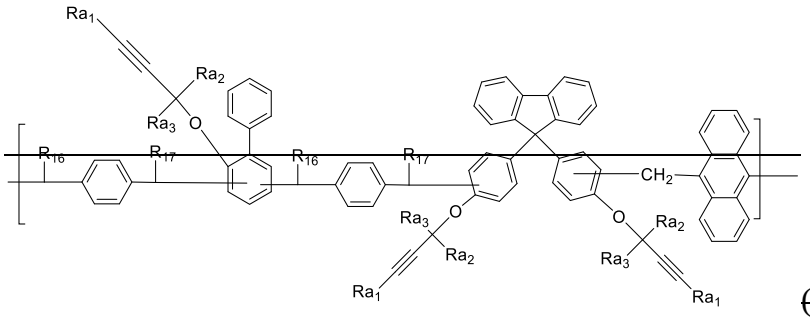


~~(XIIId).~~

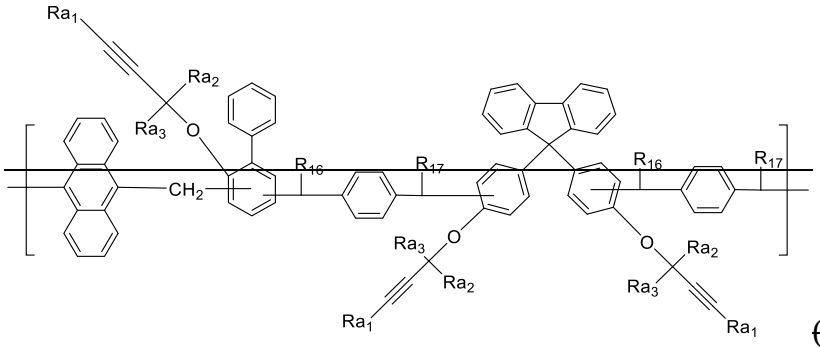
~~9. The composition of claim 1, wherein said spin on high carbon polymer comprising repeat units, selected from the group consisting of repeat units having structures (XIIIe), (XIIIf), (XIIIg), (XIIIh), and (XIIIi), and mixtures thereof,~~



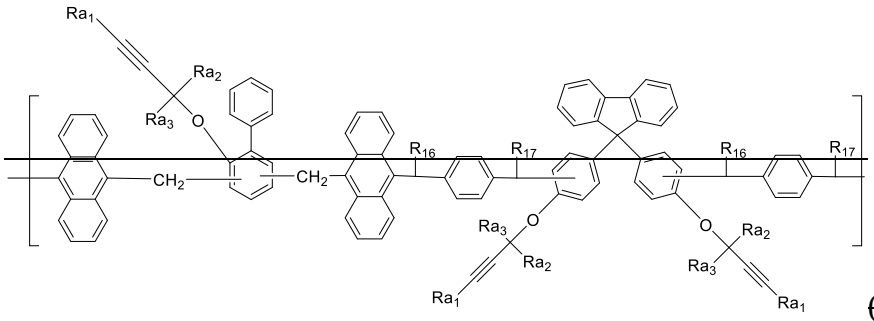
~~(XIIIe),~~



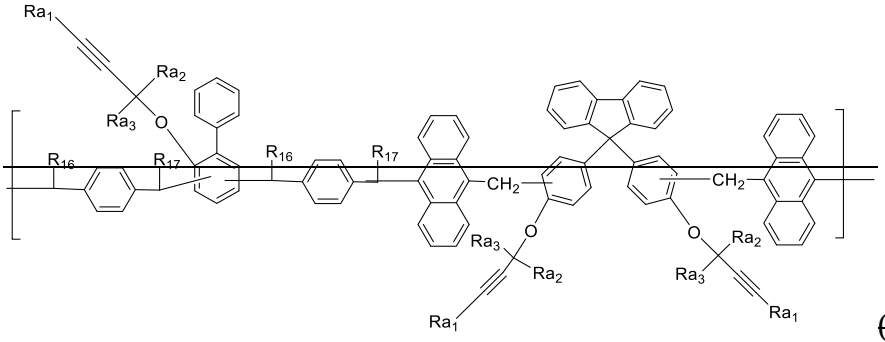
~~(XIIIf),~~



~~(XIIIg),~~

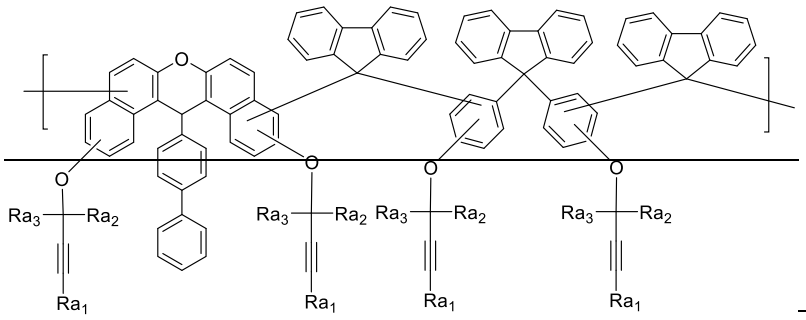


~~(XIIIh),~~



~~(XIIIi).~~

10. The composition of claim 1, wherein said spin on high carbon polymer comprises repeat units, having structures (XIV),



(XIV).

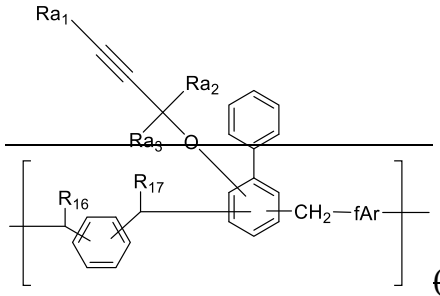
11. The composition of claim 1, wherein, component a), is a mixture of two or more different metal compounds having structure (I).

12. A process of manufacturing an electronic device comprising:

a) applying a composition of claim 1 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.

13. A spin on high carbon polymer comprising a repeat unit of structure (XII), wherein fAr is a fused aromatic ring and Ra_1, Ra_2, $Ra_{3[WS1]}$, R_{16} and R_{17} are each independently hydrogen or a C_1 to C_4 alkyl;

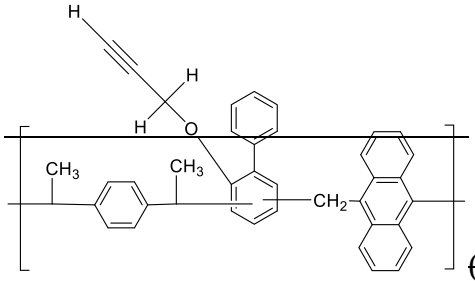


(XII).

14. The spin on high carbon polymer of claim 13, wherein, fAr is a group comprising 2-8 fused aromatic rings.

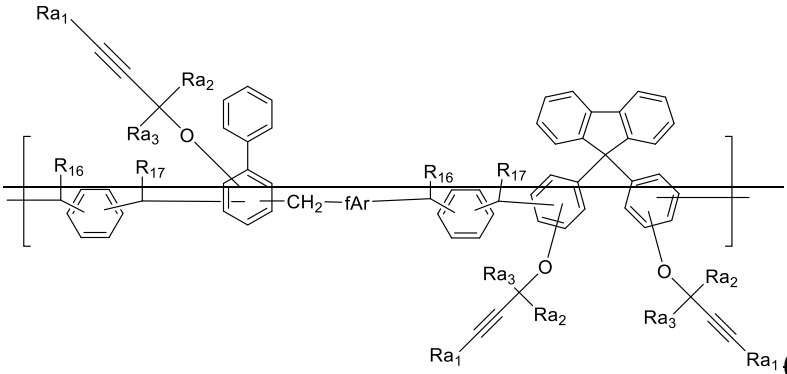
15. The spin on high carbon polymer of claim 13, wherein fAr is anthracene.

16. The spin on high carbon polymer of claim of claim 13, wherein said repeat unit has structure (XIIc);

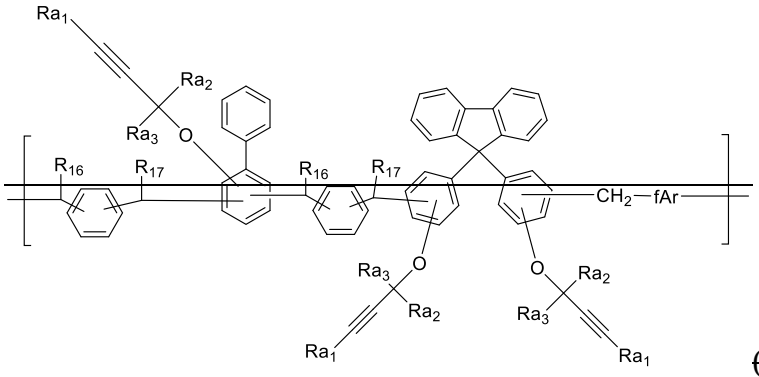


~~(XIIc).~~

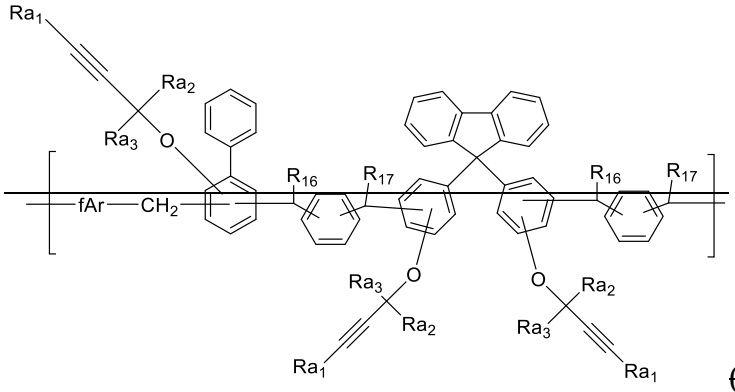
~~17. A spin on high carbon polymer comprising repeat units, selected from the group consisting of repeat units having structures (XIII), (XIIIa), (XIIIb), (XIIIc), and (XIIId), and mixtures thereof,~~



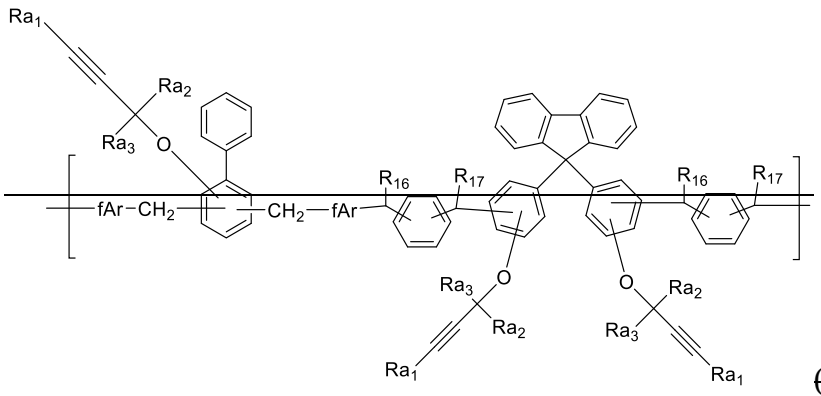
~~(XIII),~~



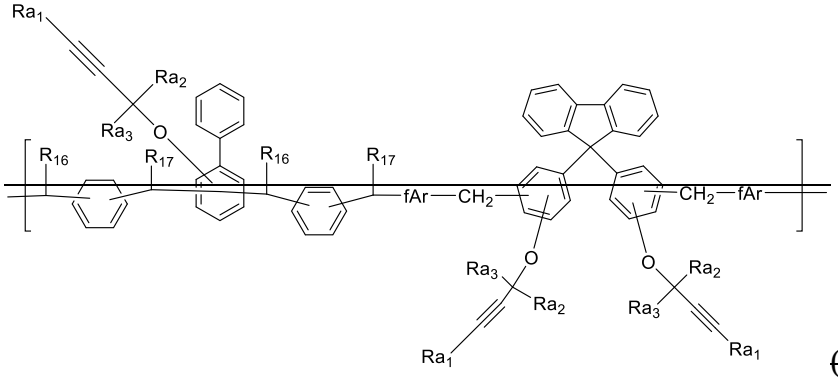
~~(XIIIa),~~



~~(XIIIb),~~



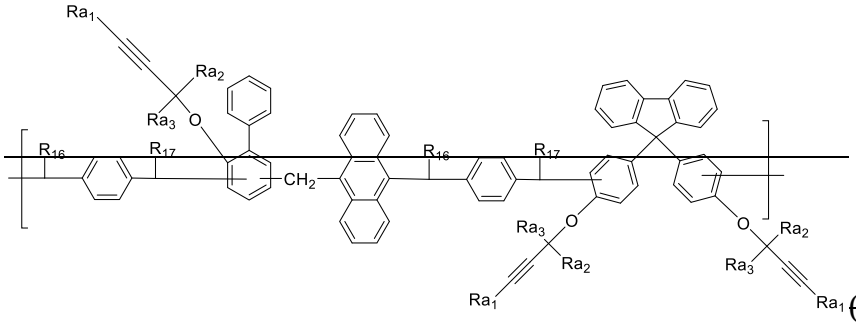
~~(XIIIc),~~



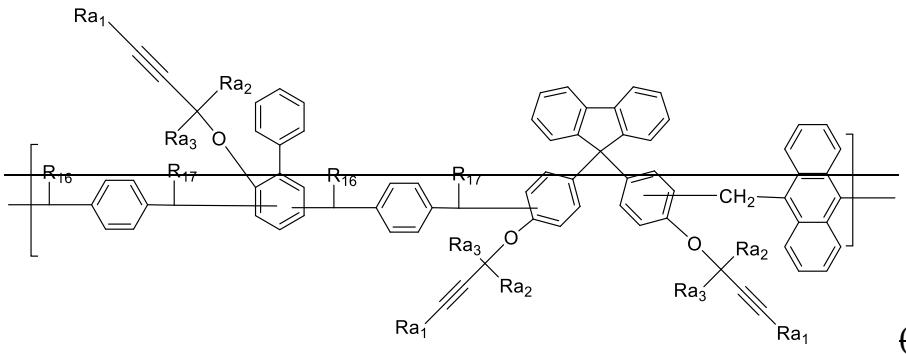
~~(XIIId)~~

~~wherein fAr is a fused aromatic ring and Ra_1, Ra_2, Ra_3, R_{16} and R_{17} are each independently selected from the group of hydrogen and a C_1 to C_4 alkyl.~~

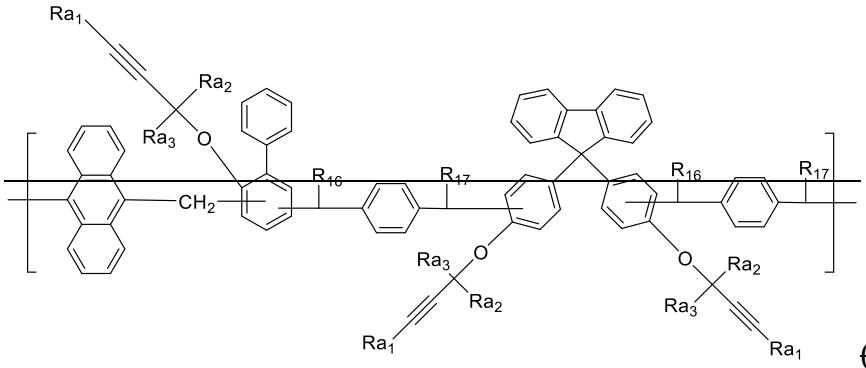
~~18. The spin on high carbon polymer of claim 17, wherein said spin on high carbon polymer comprising repeat units, selected from the group consisting of repeat units having structures (XIIIe), (XIIIf), (XIIIg), (XIIIh), and (XIIIi), and mixtures thereof,~~



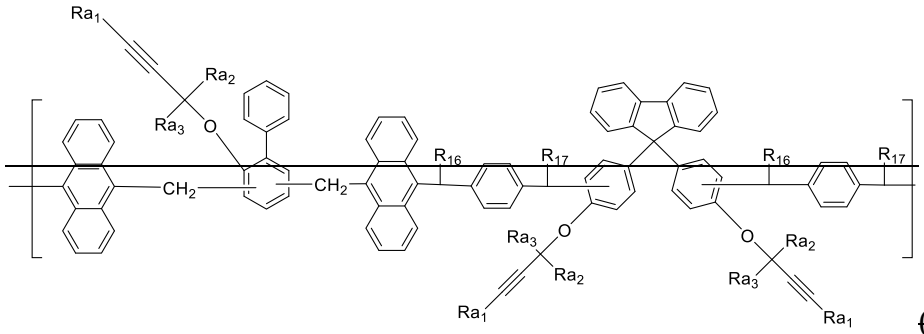
~~(XIIIe),~~



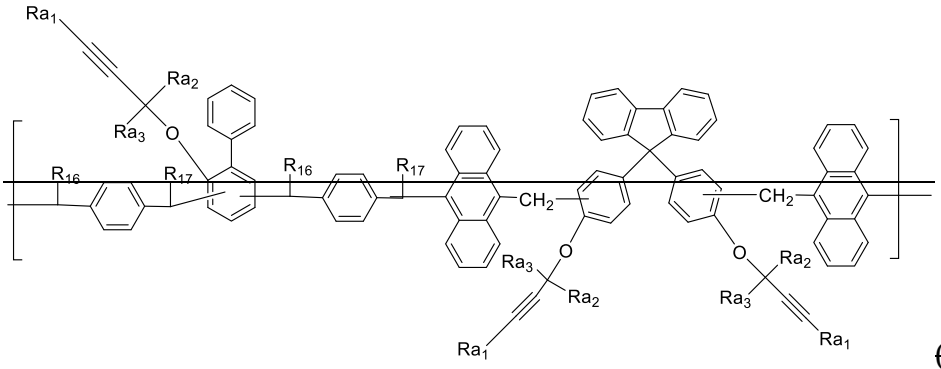
~~(XIIIf),~~



~~(XIIIg),~~



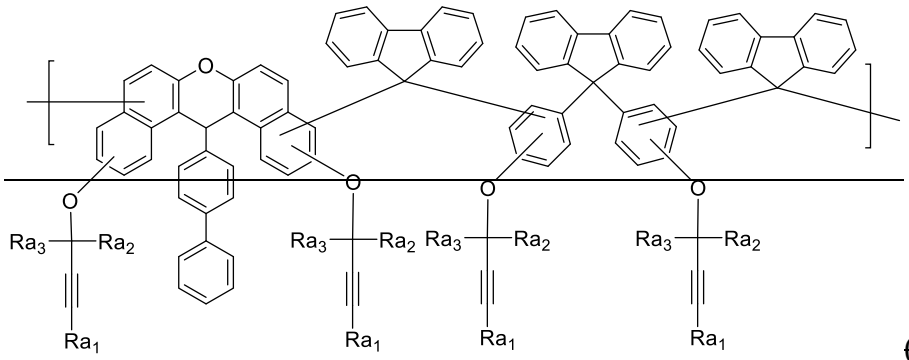
~~(XIIIh),~~



~~(XIIIi)~~

~~wherein fAr is a fused aromatic ring and Ra_1, Ra_2, Ra_3, R_{16} and R_{17} are each independently selected from the group of hydrogen and a C_1 to C_4 alkyl.~~

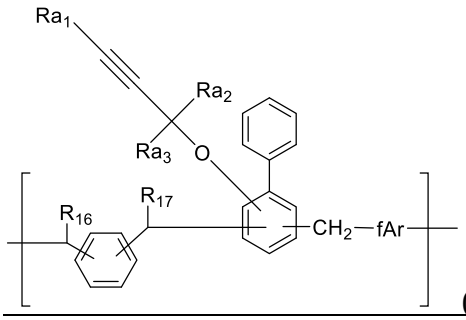
~~19. A spin on high carbon polymer is a spin on high carbon polymer comprising repeat units having structures (XIV),~~



~~(XIV).~~

~~20. The spin on high carbon polymer of claim 19, wherein Ra_1, Ra_2 and Ra_3 are hydrogen.~~

1. A spin on high carbon polymer comprising a repeat unit of structure (XII), wherein fAr is a fused aromatic ring and Ra_1, Ra_2, Ra_3, R_{16} and R_{17} are each independently hydrogen or a C_1 to C_4 alkyl;

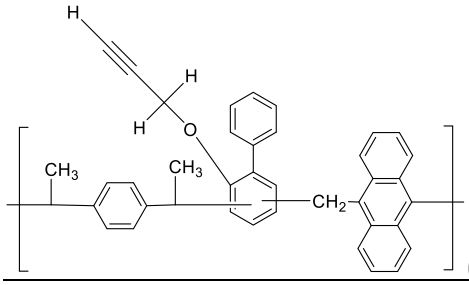


(XII).

2. The spin on high carbon polymer of claim 1, wherein fAr is a group comprising 2-8 fused aromatic rings.

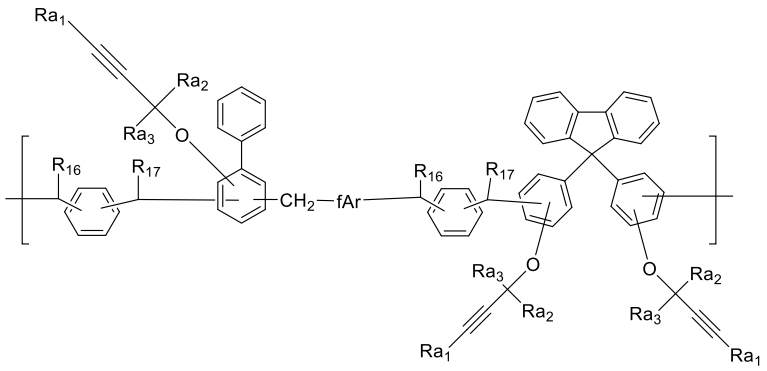
3. The spin on high carbon polymer of claim 1, wherein fAr is anthracene.

4. The spin on high carbon polymer of claim of claim 1, wherein said repeat unit has structure (XIIc):

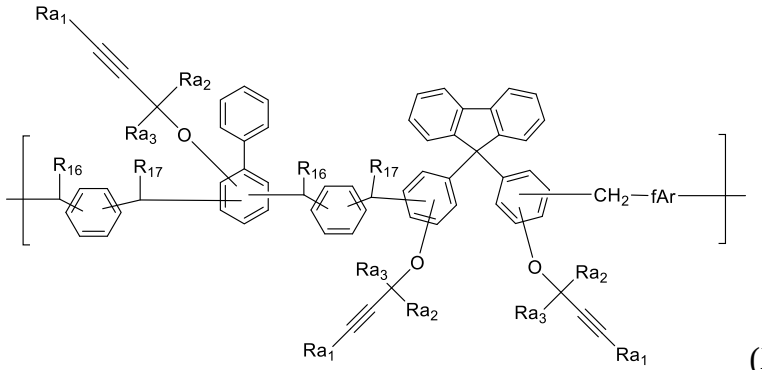


(XIIc).

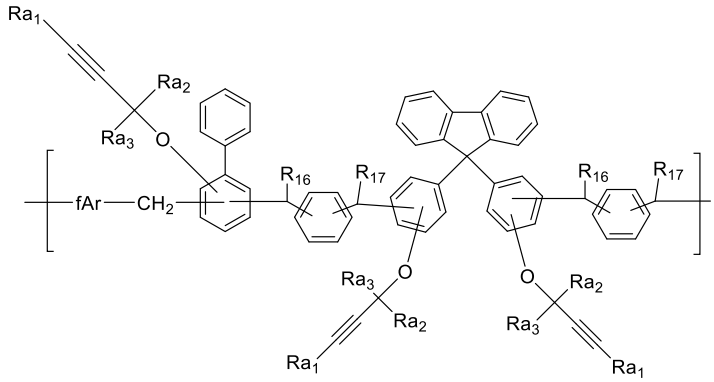
5. A spin on high carbon polymer comprising repeat units, selected from the group consisting of repeat units having structures (XIII), (XIIIa), (XIIIb), (XIIIc) and (XIIId), and mixtures thereof,



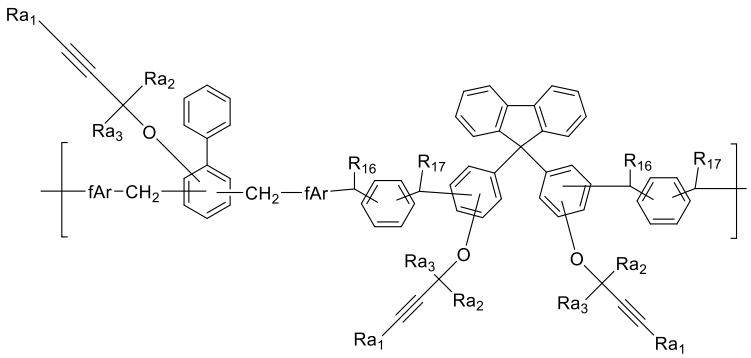
(XIII),



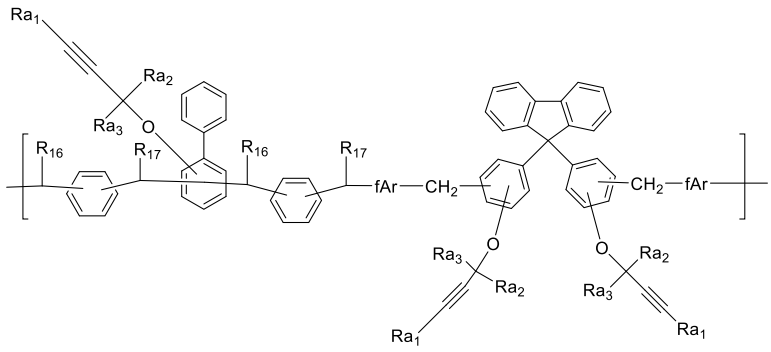
(XIIIa),



(XIIIb),



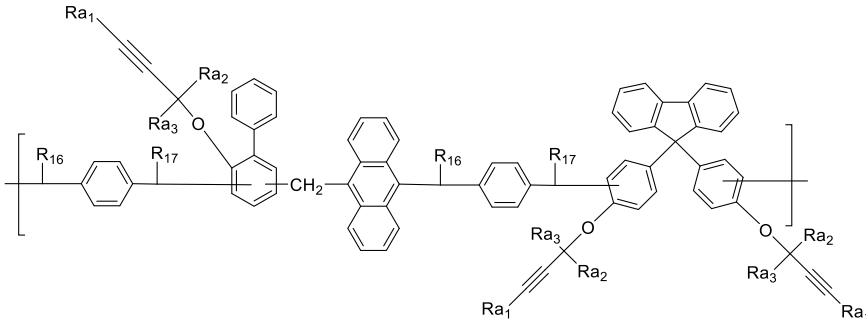
(XIIIc),



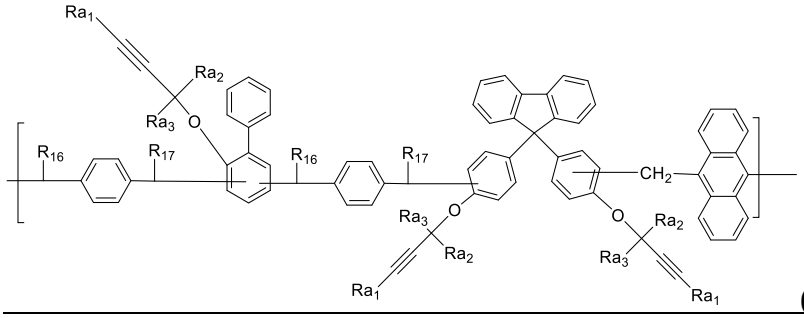
(XIIId),

wherein fAr is a fused aromatic ring and Ra_1, Ra_2, Ra_3, R_{16} and R_{17} are each independently selected from the group of hydrogen and a C_1 to C_4 alkyl.

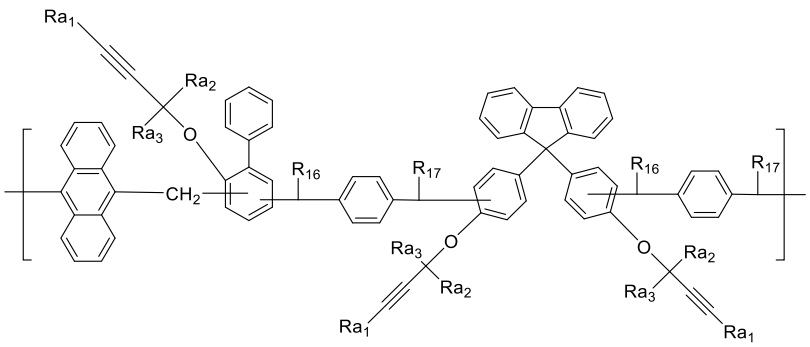
6. The spin on high carbon polymer of claim 5, wherein said spin on high carbon polymer comprising repeat units, selected from the group consisting of repeat units having structures (XIIIe), (XIIIf), (XIIIg), (XIIIh), and (XIIIi), and mixtures thereof,



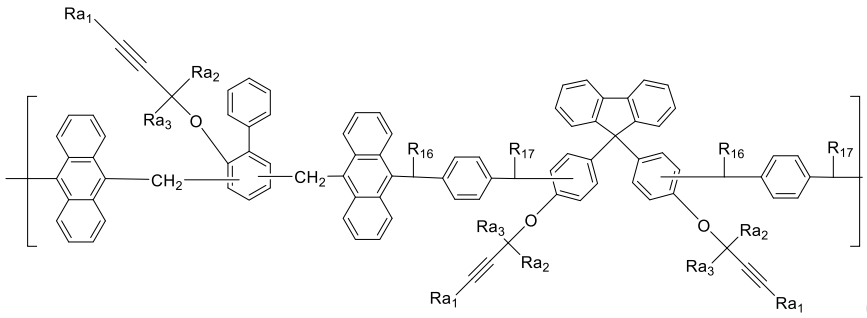
(XIIIe),



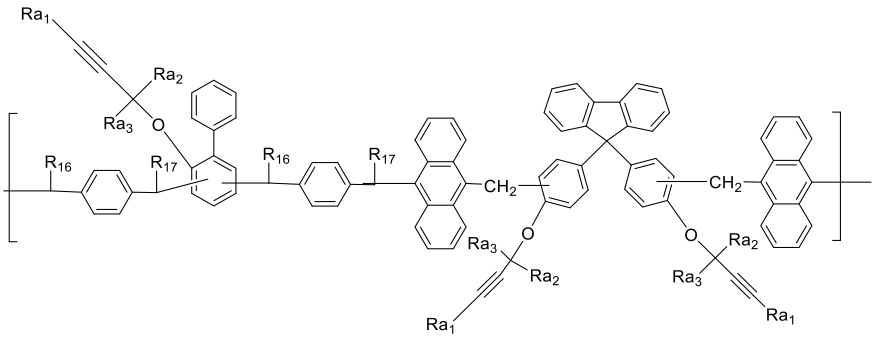
(XIIIf),



(XIIIg),



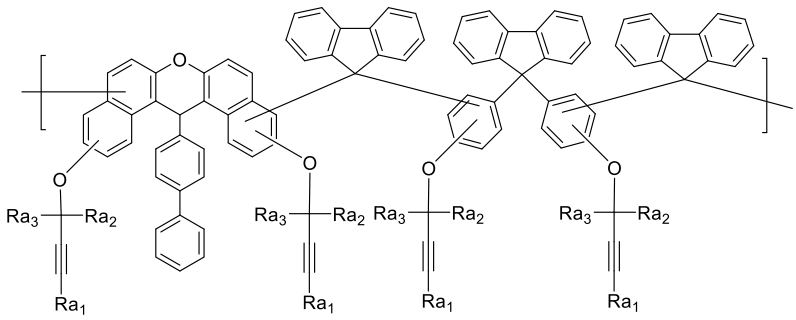
(XIIIh),



(XIIIi),

wherein fAr is a fused aromatic ring and Ra_1, Ra_2, Ra_3, R_{16} and R_{17} are each independently selected from the group of hydrogen and a C_1 to C_4 alkyl.

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



(XIV).

wherein Ra1, Ra2 and Ra3 are each independently selected from the group of hydrogen and a C_1 to C_4 alkyl.

8. The spin on high carbon polymer of claim 7, wherein Ra_1, Ra_2 and Ra_3 are hydrogen.