Patent Claims

1. Formulation comprising one or more organic semiconducting compounds (OSC), and one or more organic solvents, characterized in that said formulation comprises a viscosity at 25°C of less than 15 mPas and the boiling point of the solvent is at most 400°C.

2. Formulation according to claim 1, characterized in that said formulation comprises a viscosity at 25°C in the range of 0.5 to 9.5 mPas.

3. Formulation according to claim 1 or 2, characterized in that said formulation is a solution.

4. Formulation according to one or more of claims 1 to 3, characterized in that said formulation comprises a surface tension in the range of 22 mN/m to 50 mN/m.

5. Formulation according to one or more of claims 1 to 4, characterized in that said organic solvent comprises Hansen Solubility parameters of H_d in the range of 17.0 to 23.2 $MPa^{0.5}$, H_p in the range of 0.2 to 12.5 $MPa^{0.5}$ and H_h in the range of 0.0 to 20.0 $MPa^{0.5}$.

6. Formulation according to claim 5, characterized in that said organic solvent comprises Hansen Solubility parameters of H_d in the range of 17.0 to 23.2 $MPa^{0.5}$, H_p in the range of 0.2 to 10.5 $MPa^{0.5}$ and H_h in the range of 0.0 to 5.0 $MPa^{0.5}$.

7. Formulation according to one or more of claims 1 to 6, characterized in that said organic solvent comprises one or more of an aromatic and/or heteroaromatic compound.

8. Formulation according to claim 7, characterized in that said organic solvent comprises of one or more aromatic hydrocarbon compound.

9. Formulation according to claim 8, characterized in that said aromatic hydrocarbon compound comprises a cycloalkyl group.

10. Formulation according to claim 8, characterized in that said aromatic hydrocarbon compound comprises an alkyl group having 1 to 8 carbon atoms.

11. Formulation according to one or more of claims 1 to 10, characterized in that said organic solvent or solvent blend is a mixture of hydrocarbon aromatic compounds.

12. Formulation according to one or more of claims 1 to 11, characterized in that said organic solvent comprises a boiling point of at least 130°C.

13. Formulation according to one or more of claims 1 to 12, characterized in that said organic solvent is a mixture of compounds having different boiling points and the boiling point of the compound with the lowest boiling point is at least 10°C below the boiling point of the compound with the highest boiling point.

14. Formulation according to one or more of claims 1 to 13, characterized in that said organic solvent is a mixture of compounds having different boiling points and the boiling point of the compound with the lowest boiling point is at most 100°C below the boiling point of the compound with the highest boiling point.

15. Formulation according to one or more of claims 1 to 14, characterized in that said formulation comprises at least 80 % by weight of said organic solvents.

16. Formulation according to one or more of claims 1 to 15, characterized in that said solvent comprises a partition ratio log P of at least 1.5.

17. Formulation according to one or more of claims 1 to 16, characterized in that said formulation comprises at least one inert binder.

18. Formulation according to claim 17, characterized in that said inert binder is a polymer comprising repeating units derived from styrene monomers and/or olefins.

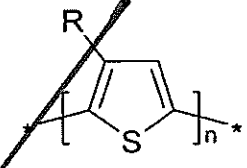
19. Formulation according to claim 17 or 18, characterized in that said inert binder is a polymer comprising at least 80 % by weight of repeating units derived from styrene monomers and/or olefins.

20. Formulation according to one or more of claims 17 to 19, characterized in that said inert binder is a polymer having a weight average molecular weight of at least 200,000 g/mol.

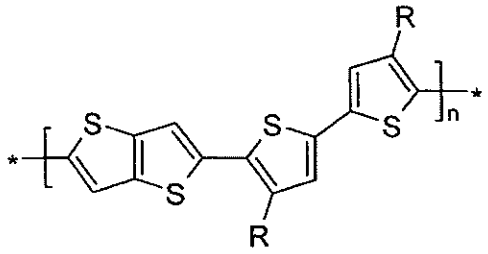
21. Formulation according to one or more of claims 1 to 20, characterized in that the organic semiconducting compound is an organic light emitting material and/or charge transporting material.

22. Formulation according to one or more of claims 1 to 21, characterized in that the organic semiconducting compound has a molecular weight of 5000 g/mol or less.

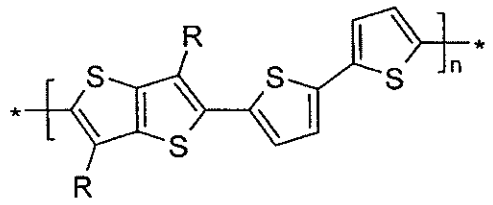
23. Formulation according to one or more of claims 1 to 22, characterized in that the organic semiconducting compound is a compound selected from the following formulae



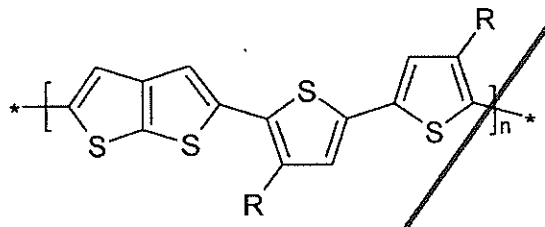
P1



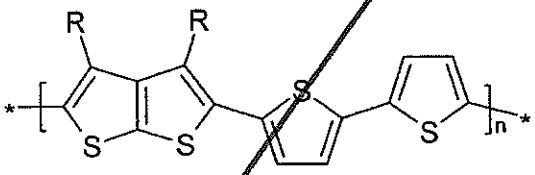
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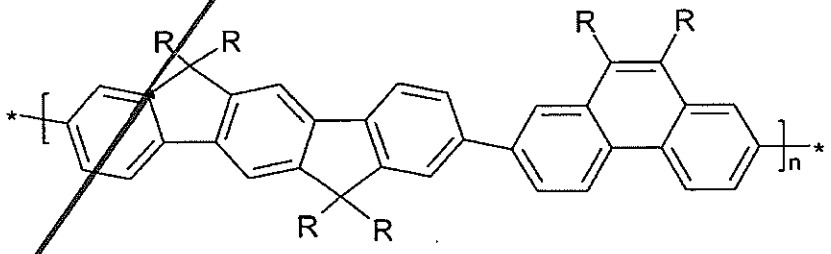
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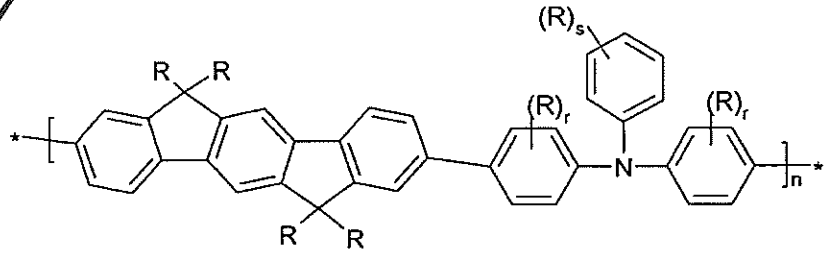
P4



P5



P6



P7

wherein

n is an integer >1, preferably from 10 to 1,000,

R on each occurrence identically or differently denotes H, F, Cl, Br, I, CN, a straight-chain, branched or cyclic alkyl group having from 1 to 40 C atoms, in which one or more C atoms are optionally replaced by O, S, O-CO, CO-O, O-CO-O, $CR^0=CR^0$ or C≡C such that O- and/or S-atoms are not linked directly to each other, and in which one or more H atoms are optionally replaced by F, Cl, Br, I or CN, or denotes an aryl or heteroaryl group having from 4 to 20 ring atoms that is unsubstituted or substituted by one or more non-aromatic groups R^s, and wherein one or more groups R may also form a mono- or polycyclic aliphatic or aromatic ring system with one another and/or with the ring to which they are attached,

R^s on each occurrence identically or differently denotes F, Cl, Br, I, CN, $Sn(R^{00})_3$, $Si(R^{00})_3$ or $B(R^{00})_2$ a straight-chain, branched or cyclic alkyl group having from 1 to 25 C atoms, in which one or more C atoms are optionally replaced by O, S, O-CO, CO-O, O-CO-O, $CR^0=CR^0$, C≡C such that O- and/or S-atoms are not linked directly to each other, and in which one or more H atoms are optionally replaced by F, Cl, Br, I or CN, or R^s denotes an aryl or heteroaryl group having from 4 to 20 ring atoms that is unsubstituted or substituted by one or more non-aromatic groups R^s, and wherein one or more groups R^s may also form a ring system with one another and/or with R,

R^0 on each occurrence identically or differently denotes H, F, Cl, CN, alkyl having from 1 to 12 C atoms or aryl or heteroaryl having from 4 to 10 ring atoms,

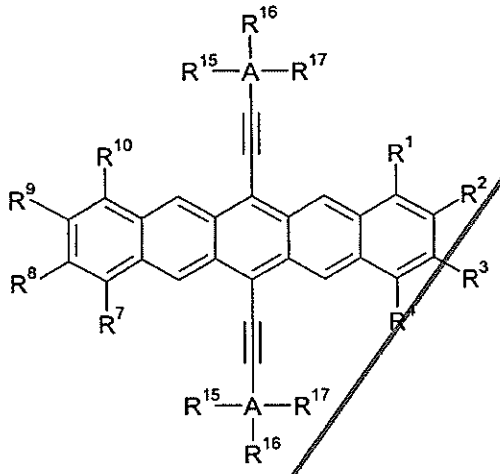
R^{00} on each occurrence identically or differently denotes H or an aliphatic or aromatic hydrocarbon group having from 1 to 20 C atoms, wherein two groups R^{00} may also form a ring together

with the hetero atom (Sn, Si or B) to which they are attached,

r is 0, 1, 2, 3 or 4,

s is 0, 1, 2, 3, 4 or 5.

24. Formulation according to one or more of claims 1 to 22, characterized in that the organic semiconducting compound is a compound of the following formula



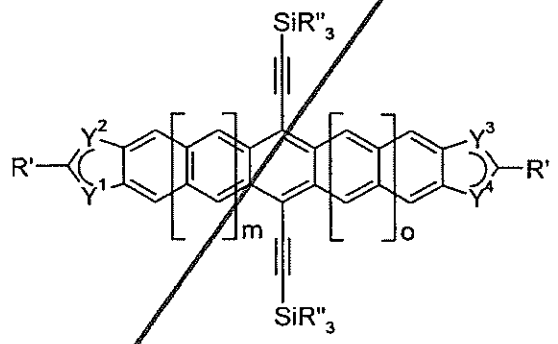
M1a

wherein R^1, R^2, R^3, R^4,R^7, R^8, R^9, R^{10}, R^{15}, R^{16}, R^{17} each independently are the same or different and each independently represents: H; an optionally substituted C_1-C_{40} carbyl or hydrocarbyl group; an optionally substituted C_1-C_{40} alkoxy group; an optionally substituted C_6-C_{40} aryloxy group; an optionally substituted C_7-C_{40} alkylaryloxy group; an optionally substituted C_2-C_{40} alkoxycarbonyl group; an optionally substituted C_7-C_{40} aryloxycarbonyl group; a cyano group (-CN); a carbamoyl group (-C(=O)NH_2); a haloformyl group (-C(=O)-X, wherein X represents a halogen atom); a formyl group (-C(=O)-H); an isocyano group; an isocyanate group; a thiocyanate group or a thioisocyanate group; an optionally substituted amino group; a hydroxy group; a nitro group; a CF_3 group; a halo group (Cl, Br, F); or an optionally substituted silyl group; and A represents Silicon or Germanium; and

wherein independently each pair of R^1 and R^2, R^2 and R^3, R^3 and R^4, R^7 and R^8, R^8 and R^9, R^9 and R^{10}, R^{15} and R^{16}, and R^{16} and R^{17} is optionally cross-bridged with each other to form a C_4-C_{40} saturated or unsaturated ring, which saturated or unsaturated ring is optionally intervened by an oxygen atom, a sulphur atom or a group of the formula -N(R^a)-, wherein R^a is a hydrogen atom or a hydrocarbon group, or is optionally substituted; and

wherein one or more of the carbon atoms of the polyacene skeleton is optionally substituted by a heteratom selected from N, P, As, O, S, Se and Te.

25. Formulation according to one or more of claims 1 to 22, characterized in that the organic semiconducting compound is a compound of the following formula



M1b1

wherein

one of Y^1 and Y^2 denotes -CH= or =CH- and the other denotes -X-,
one of Y^3 and Y^4 denotes -CH= or =CH- and the other denotes -X-,

X is -O-, -S-, -Se- or -NR'''-,

R' is H, F, Cl, Br, I, CN, straight-chain or branched alkyl or alkoxy that have 1 to 20 C-atoms and are optionally fluorinated or perfluorinated, optionally fluorinated or perfluorinated aryl

having 6 to 30 C-atoms, or CO_2R'''', with R'''' being H, optionally fluorinated alkyl having 1 to 20 C-atoms or optionally fluorinated aryl having 2 to 30 C-atoms,

R'' is, in case of multiple occurrence independently of one another, cyclic, straight-chain or branched alkyl or alkoxy that have 1 to 20, preferably 1 to 8 C-atoms, or aryl having 2-30 C-atoms, all of which are optionally fluorinated or perfluorinated,

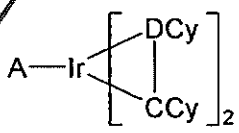
R''' is H or cyclic, straight-chain or branched alkyl with 1 to 10 C-atoms,

m is 0 or 1,

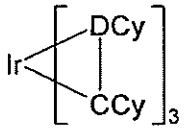
o is 0 or 1.

26. Formulation according to one or more of claims 1 to 22, characterized in that organic semiconducting compound is an organic phosphoresecent compound which emits light and in addition contains at least one atom having an atomic number greater than 38.

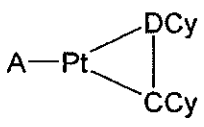
27. Formulation according to claim 26, characterized in that the phosphorescent compounds are compounds of formulae (1) to (4):



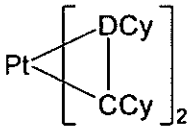
formula (1)



formula (2)



formula (3)



formula (4)

where

DCy is, identically or differently on each occurrence, a cyclic group which contains at least one donor atom, preferably nitrogen, carbon in the form of a carbene or phosphorus, via which the cyclic group is bonded to the metal, and which may in turn carry one or more substituents R^{18}; the groups DCy and CCy are connected to one another via a covalent bond;

CCy is, identically or differently on each occurrence, a cyclic group which contains a carbon atom via which the cyclic group is bonded to the metal and which may in turn carry one or more substituents R^{18};

A is, identically or differently on each occurrence, a monoanionic, bidentate chelating ligand, preferably a diketonate ligand;

R^{18} are identically or differently at each instance, and are F, Cl, Br, I, NO_2, CN, a straight-chain, branched or cyclic alkyl or alkoxy group having from 1 to 20 carbon atoms, in which one or more nonadjacent CH_2 groups may be replaced by -O-, -S-, -NR^{19}-, -$CONR^{19}$-, -CO-O-, -C=O-, -CH=CH- or -C≡C-, and in which one or more hydrogen atoms may be replaced by F, or an aryl or heteroaryl group which has from 4 to 14 carbon atoms and may be substituted by one or more nonaromatic R^{18} radicals, and a plurality of substituents R^{18}, either on the same ring or on the two different rings, may together in turn form a mono- or polycyclic, aliphatic or aromatic ring system; and

R^{19} are identically or differently at each instance, and are a straight-chain, branched or cyclic alkyl or alkoxy group having from 1 to 20 carbon atoms, in which one or more nonadjacent CH_2 groups may be replaced by -O-, -S-, -CO-O-, -C=O-, -CH=CH- or -C≡C-, and in which one or more hydrogen atoms may be replaced by F, or an aryl or heteroaryl group which has from 4 to 14 carbon atoms and may be substituted by one or more nonaromatic R^{18} radicals.

28. Formulation according to one or more of claims 1 to 27, characterized in that the formulation comprises a host material.

29. Formulation according to one or more of claims 1 to 28, characterized in that the formulation comprises 0.1 to 5 % by weight organic semiconducting compounds.

30. Formulation according to one or more of claims 17 to 29, characterized in that the weight ratio of said semiconducting compound to said inert binder is in the range of 5:1 to 1:1.

31. Formulation according to one or more of claims 1 to 30, characterized in that the formulation comprises at least one wetting agent.

32. Formulation according to claim 31, characterized in that said wetting agent is volatile and is not capable of chemically reacting with said semiconducting compound.

33. Use of a formulation according to one or more of claims 1 to 32 as coating or printing ink for the preparation of OE devices.

34. Process of preparing an organic electronic (OE) device, comprising the steps of
a) depositing the formulation according to one or more of claims 1 to 32 onto a substrate to form a film or layer,
b) removing the solvent(s).

35. Process according to claim 34, characterized in that the formulation according to one of the claims 1 to 32 is applied by gravure printing, doctor blade coating, roller printing, reverse-roller printing, flexographic printing, web printing.

36. Process according to claim 34 or 35, characterized in that the cell etch of the printing device is in the range of 4 cm^3/m^2 to 18 cm^3/m^2.

37. Process according to one or more of claims 34 to 36, characterized in that the print speed is 100 m/minute or less.

38. Process according to claim 34 or 35, characterized in that the surface on which the formulation according to one or more of claims 1 to 32 is applied comprises a surface energy in the range of 25 to 130 mN m^{-1}.

39. Process according to one or more of claims 34 to 38, characterized in that the evaporation of the solvent is achieved below the boiling point of the solvent.

40. OE device prepared from a formulation according to one or more of claims 1 to 32 or by a process according to one or more of claims 34 to 39.

41. OE device according to claim 40, characterized in that it is an organic light emitting diode (OLED), an organic field effect transistor (OFET) or an organic photovoltaic (OPV) device.

42. OE device according to claim 40, characterized in that it comprises a top gate design.

43. OE device according to claim 40, characterized in that it comprises a bottom gate design.

Patent Claims

1. Process of preparing an organic electronic (OE) device, comprising the steps of a) depositing a formulation comprising one or more organic semiconducting compounds (OSC), and one or more organic solvents, characterized in that said formulation comprises a viscosity at 25 ^{0}C of less than 15 m Pas and the boiling point of the solvent is at most 400 ^{0}C, onto a substrate to form a film or layer,
b) removing the solvent(s), characterized in that the formulation is applied by gravure printing, doctor blade coating, roller printing, reverse-roller printing, flexographic printing, web printing.

2. The process according to claim 1, characterized in that said formulation comprises a viscosity at 25°C in the range of 0.5 to 9.5 mPas.

3. The process according to claim 1 or 2, characterized in that said formulation is a solution.

4. The process according to one or more of claims 1 to 3, characterized in that said formulation comprises a surface tension in the range of 22 mN/m to 50 mN/m.

5. The process according to one or more of claims 1 to 4, characterized in that said organic solvent comprises Hansen Solubility parameters of H_d in the range of 17.0 to 23.2 $MPa^{0.5}$, H_p in the range of 0.2 to 12.5 $MPa^{0.5}$ and H_h in the range of 0.0 to 20.0 $MPa^{0.5}$.

6. The process according to claim 5, characterized in that said organic solvent comprises Hansen Solubility parameters of H_d in the range of 17.0 to 23.2 $MPa^{0.5}$, H_p in the range of 0.2 to 10.5 $MPa^{0.5}$ and H_h in the range of 0.0 to 5.0 $MPa^{0.5}$.

7. The process according to one or more of claims 1 to 6, characterized in that said organic solvent comprises one or more of an aromatic and/or heteroaromatic compound.

8. The process according to claim 7, characterized in that said organic solvent comprises of one or more aromatic hydrocarbon compound.

9. The process according to claim 8, characterized in that said aromatic hydrocarbon compound comprises a cycloalkyl group.

10. The process according to claim 8, characterized in that said aromatic hydrocarbon compound comprises an alkyl group having 1 to 8 carbon atoms.

11. The process according to one or more of claims 1 to 10, characterized in that said organic solvent or solvent blend is a mixture of hydrocarbon aromatic compounds.

12. The process according to one or more of claims 1 to 11, characterized in that said organic solvent comprises a boiling point of at least 130°C.

13. The process according to one or more of claims 1 to 12, characterized in that said organic solvent is a mixture of compounds having different boiling points and the boiling point of the compound with the lowest boiling point is at least 10°C below the boiling point of the compound with the highest boiling point.

14. The process according to one or more of claims 1 to 13, characterized in that said organic solvent is a mixture of compounds having different boiling points and the boiling point of the compound with the lowest boiling point is at most 100°C below the boiling point of the compound with the highest boiling point.

15. The process according to one or more of claims 1 to 14, characterized in that said formulation comprises at least 80 % by weight of said organic solvents.

16. The process according to one or more of claims 1 to 15, characterized in that said solvent comprises a partition ratio log P of at least 1.5.

17. The process according to one or more of claims 1 to 16, characterized in that said formulation comprises at least one inert binder.

18. The process according to claim 17, characterized in that said inert binder is a polymer comprising repeating units derived from styrene monomers and/or olefins.

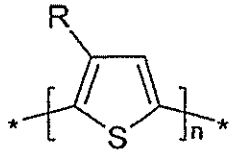
19. The process according to claim 17 or 18, characterized in that said inert binder is a polymer comprising at least 80 % by weight of repeating units derived from styrene monomers and/or olefins.

20. The process according to one or more of claims 17 to 19, characterized in that said inert binder is a polymer having a weight average molecular weight of at least 200,000 g/mol.

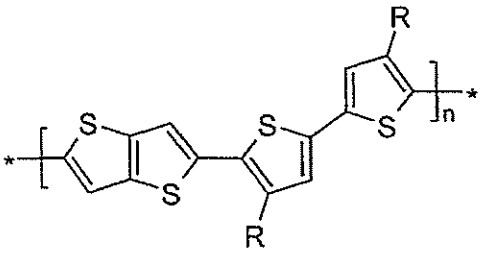
21. The process according to one or more of claims 1 to 20, characterized in that the organic semiconducting compound is an organic light emitting material and/or charge transporting material.

22. The process according to one or more of claims 1 to 21, characterized in that the organic semiconducting compound has a molecular weight of 5000 g/mol or less.

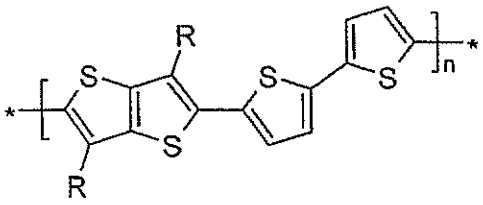
23. The process according to one or more of claims 1 to 22, characterized in that the organic semiconducting compound is a compound selected from the following formulae



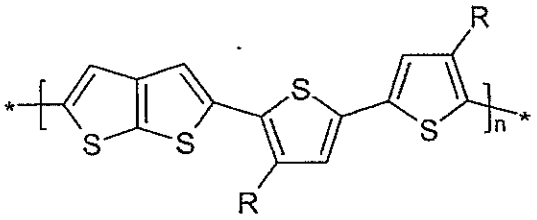
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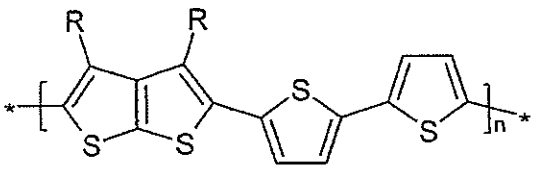
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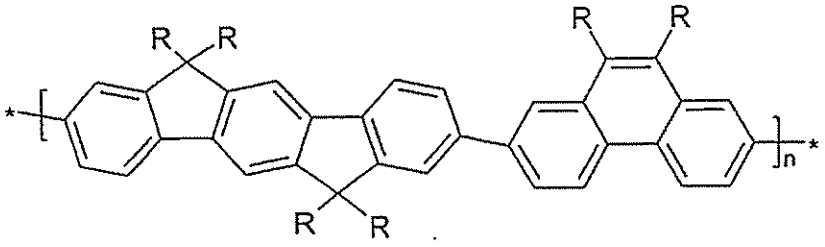
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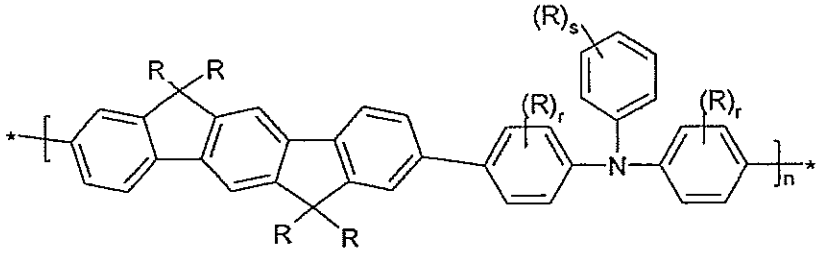
P4



P5



P6



P7

wherein

n is an integer >1, preferably from 10 to 1,000,

R on each occurrence identically or differently denotes H, F, Cl, Br, I, CN, a straight-chain, branched or cyclic alkyl group having from 1 to 40 C atoms, in which one or more C atoms are optionally replaced by O, S, O-CO, CO-O, O-CO-O, $CR^0=CR^0$ or C≡C such that O- and/or S-atoms are not linked directly to each other, and in which one or more H atoms are optionally replaced by F, Cl, Br, I or CN, or denotes an aryl or heteroaryl group having from 4 to 20 ring atoms that is unsubstituted or substituted by one or more non-aromatic groups R^s, and wherein one or more groups R may also form a mono- or polycyclic aliphatic or aromatic ring system with one another and/or with the ring to which they are attached,

R^s on each occurrence identically or differently denotes F, Cl, Br, I, CN, $Sn(R^{00})_3$, $Si(R^{00})_3$ or $B(R^{00})_2$ a straight-chain, branched or cyclic alkyl group having from 1 to 25 C atoms, in which one or more C atoms are optionally replaced by O, S, O-CO, CO-O, O-CO-O, $CR^0=CR^0$, C≡C such that O- and/or S-atoms are not linked directly to each other, and in which one or more H atoms are optionally replaced by F, Cl, Br, I or CN, or R^s denotes an aryl or heteroaryl group having from 4 to 20 ring atoms that is unsubstituted or substituted by one or more non-aromatic groups R^s, and wherein one or more groups R^s may also form a ring system with one another and/or with R,

R^0 on each occurrence identically or differently denotes H, F, Cl, CN, alkyl having from 1 to 12 C atoms or aryl or heteroaryl having from 4 to 10 ring atoms,

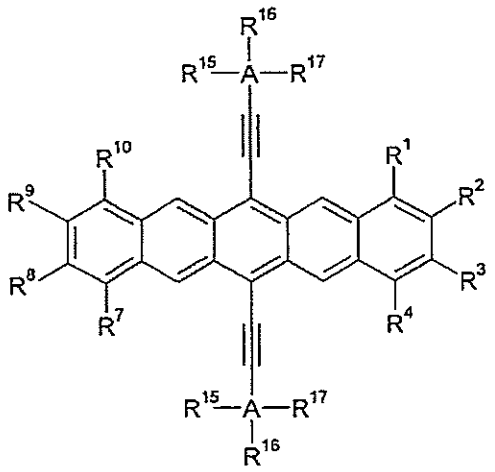
R^{00} on each occurrence identically or differently denotes H or an aliphatic or aromatic hydrocarbon group having from 1 to 20 C atoms, wherein two groups R^{00} may also form a ring together

with the hetero atom (Sn, Si or B) to which they are attached,

r is 0, 1, 2, 3 or 4,

s is 0, 1, 2, 3, 4 or 5.

24. The process according to one or more of claims 1 to 22, characterized in that the organic semiconducting compound is a compound of the following formula



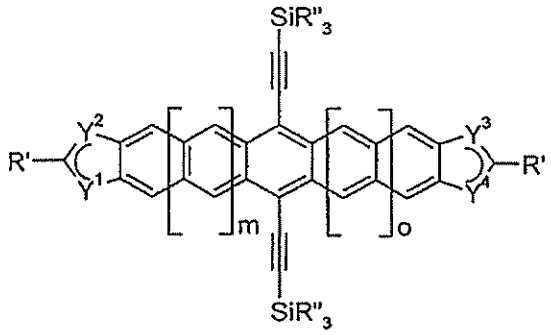
M1a

wherein R^1, R^2, R^3, R^4,R^7, R^8, R^9, R^{10}, R^{15}, R^{16}, R^{17} each independently are the same or different and each independently represents: H; an optionally substituted C_1-C_{40} carbyl or hydrocarbyl group; an optionally substituted C_1-C_{40} alkoxy group; an optionally substituted C_6-C_{40} aryloxy group; an optionally substituted C_7-C_{40} alkylaryloxy group; an optionally substituted C_2-C_{40} alkoxycarbonyl group; an optionally substituted C_7-C_{40} aryloxycarbonyl group; a cyano group (-CN); a carbamoyl group (-C(=O)NH_2); a haloformyl group (-C(=O)-X, wherein X represents a halogen atom); a formyl group (-C(=O)-H); an isocyano group; an isocyanate group; a thiocyanate group or a thioisocyanate group; an optionally substituted amino group; a hydroxy group; a nitro group; a CF_3 group; a halo group (Cl, Br, F); or an optionally substituted silyl group; and A represents Silicon or Germanium; and

wherein independently each pair of R^1 and R^2, R^2 and R^3, R^3 and R^4, R^7 and R^8, R^8 and R^9, R^9 and R^{10}, R^{15} and R^{16}, and R^{16} and R^{17} is optionally cross-bridged with each other to form a C_4-C_{40} saturated or unsaturated ring, which saturated or unsaturated ring is optionally intervened by an oxygen atom, a sulphur atom or a group of the formula -N(R^a)-, wherein R^a is a hydrogen atom or a hydrocarbon group, or is optionally substituted; and

wherein one or more of the carbon atoms of the polyacene skeleton is optionally substituted by a heteratom selected from N, P, As, O, S, Se and Te.

25. The process according to one or more of claims 1 to 22, characterized in that the organic semiconducting compound is a compound of the following formula



M1b1

wherein

one of Y^1 and Y^2 denotes -CH= or =CH- and the other denotes -X-,
one of Y^3 and Y^4 denotes -CH= or =CH- and the other denotes -X-,

X is -O-, -S-, -Se- or -NR'''-,

R' is H, F, Cl, Br, I, CN, straight-chain or branched alkyl or alkoxy that have 1 to 20 C-atoms and are optionally fluorinated or perfluorinated, optionally fluorinated or perfluorinated aryl

having 6 to 30 C-atoms, or CO_2R'''', with R'''' being H, optionally fluorinated alkyl having 1 to 20 C-atoms or optionally fluorinated aryl having 2 to 30 C-atoms,

R'' is, in case of multiple occurrence independently of one another, cyclic, straight-chain or branched alkyl or alkoxy that have 1 to 20, preferably 1 to 8 C-atoms, or aryl having 2-30 C-atoms, all of which are optionally fluorinated or perfluorinated,

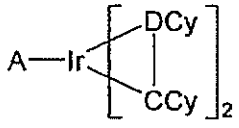
R''' is H or cyclic, straight-chain or branched alkyl with 1 to 10 C-atoms,

m is 0 or 1,

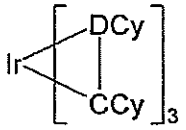
o is 0 or 1.

26. The process according to one or more of claims 1 to 22, characterized in that organic semiconducting compound is an organic phosphoresecent compound which emits light and in addition contains at least one atom having an atomic number greater than 38.

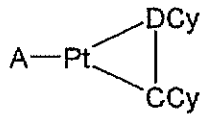
27. The process according to claim 26, characterized in that the phosphorescent compounds are compounds of formulae (1) to (4):



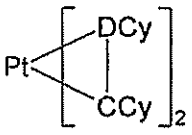
formula (1)



formula (2)



formula (3)



formula (4)

where

DCy is, identically or differently on each occurrence, a cyclic group which contains at least one donor atom, preferably nitrogen, carbon in the form of a carbene or phosphorus, via which the cyclic group is bonded to the metal, and which may in turn carry one or more substituents R^{18}; the groups DCy and CCy are connected to one another via a covalent bond;

CCy is, identically or differently on each occurrence, a cyclic group which contains a carbon atom via which the cyclic group is bonded to the metal and which may in turn carry one or more substituents R^{18};

A is, identically or differently on each occurrence, a monoanionic, bidentate chelating ligand, preferably a diketonate ligand;

R^{18} are identically or differently at each instance, and are F, Cl, Br, I, NO_2, CN, a straight-chain, branched or cyclic alkyl or alkoxy group having from 1 to 20 carbon atoms, in which one or more nonadjacent CH_2 groups may be replaced by -O-, -S-, -NR^{19}-, -$CONR^{19}$-, -CO-O-, -C=O-, -CH=CH- or -C≡C-, and in which one or more hydrogen atoms may be replaced by F, or an aryl or heteroaryl group which has from 4 to 14 carbon atoms and may be substituted by one or more nonaromatic R^{18} radicals, and a plurality of substituents R^{18}, either on the same ring or on the two different rings, may together in turn form a mono- or polycyclic, aliphatic or aromatic ring system; and

R^{19} are identically or differently at each instance, and are a straight-chain, branched or cyclic alkyl or alkoxy group having from 1 to 20 carbon atoms, in which one or more nonadjacent CH_2 groups may be replaced by -O-, -S-, -CO-O-, -C=O-, -CH=CH- or -C≡C-, and in which one or more hydrogen atoms may be replaced by F, or an aryl or heteroaryl group which has from 4 to 14 carbon atoms and may be substituted by one or more nonaromatic R^{18} radicals.

28. The process according to one or more of claims 1 to 27, characterized in that the formulation comprises a host material.

29. The process according to one or more of claims 1 to 28, characterized in that the formulation comprises 0.1 to 5 % by weight organic semiconducting compounds.

30. The process according to one or more of claims 17 to 29, characterized in that the weight ratio of said semiconducting compound to said inert binder is in the range of 5:1 to 1:1.

31. The process according to one or more of claims 1 to 30, characterized in that the formulation comprises at least one wetting agent.

32. The process according to claim 31, characterized in that said wetting agent is volatile and is not capable of chemically reacting with said semiconducting compound.

33. Use of a formulation according to one or more of claims 1 to 32 as coating or printing ink for the preparation of OE devices.

34. Process of preparing an organic electronic (OE) device, comprising the steps of
a) depositing the formulation according to one or more of claims 1 to 32 onto a substrate to form a film or layer,
b) removing the solvent(s).

35. Process according to claim 34, characterized in that the formulation according to one of the claims 1 to 32 is applied by gravure printing, doctor blade coating, roller printing, reverse-roller printing, flexographic printing, web printing.

36. Process according to claim 34 or 35, characterized in that the cell etch of the printing device is in the range of 4 cm^3/m^2 to 18 cm^3/m^2.

37. Process according to one or more of claims 34 to 36, characterized in that the print speed is 100 m/minute or less.

38. Process according to claim 34 or 35, characterized in that the surface on which the formulation according to one or more of claims 1 to 32 is applied comprises a surface energy in the range of 25 to 130 mN m^{-1}.

39. Process according to one or more of claims 34 to 38, characterized in that the evaporation of the solvent is achieved below the boiling point of the solvent.