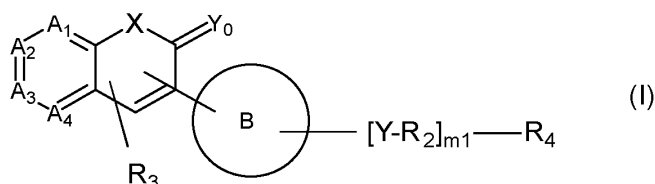
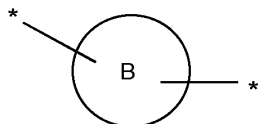


Patent claims

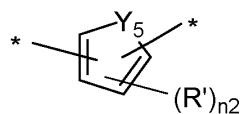
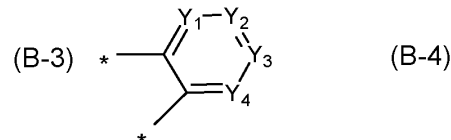
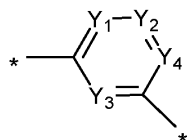
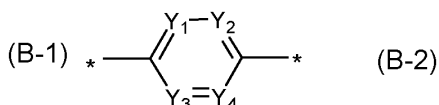
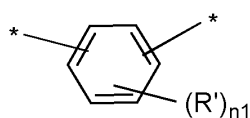
1. An ophthalmic device or a precursor article for manufacturing an ophthalmic device comprising at least one polymerized compound of formula (I)



wherein



the divalent group is selected from the group of formulae (B-1), (B-2), (B-3), (B-4) or (B-5)



(B-5)

the asterisk * indicates the linkage to the remainder of formula (I);

Y_1 , Y_2 , Y_3 , Y_4 are each independently of each other CR' or N , provided that only one of Y_1 , Y_2 , Y_3 and Y_4 is N and the others are CR' ;

Y_5 is O , S or NR_B ;

R_B is at each occurrence independently selected from a linear or branched alkyl group having 1 to 10 C atoms or a linear or

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branched partially or fully fluorinated alkyl group having 1 to 10 C atoms;

X is O or S;

Y₀ is O or S;

5 A₁, A₂, A₃, A₄ are each independently of each other N, CR" or C-Y-R₂-R₁, provided that in case m₁ is 1 only one of A₁, A₂, A₃ and A₄ is N and the others are CR" and provided that in case m₁ is 0, only one of A₁, A₂, A₃ and A₄ is N, only one of A₁, A₂, A₃ and A₄ is C-Y-R₂-R₁ and the others are each independently CR";

10 or

in case of m₁ is 0, adjacent A₁-A₂, A₂-A₃ or A₃-A₄ are each independently of each other -N(R₂-R₁)-C(=O)- or -C(=O)-N(R₂-R₁)- and the remaining A₃, A₄, A₁ and A₂ are each independently of each other CR";

15 Y is independently of each other O, S, SO₂, or a bond;

m₁ is 0 or 1;

n₁ is 4;

n₂ is 2;

20 R' is at each occurrence independently selected from the group consisting of H, F, SF₅, CN, SO₂CF₃, a linear or branched, non-halogenated, partially or completely halogenated alkyl group having 1 to 20 C atoms, a non-halogenated, partially or completely halogenated cycloalkyl group having 3 to 6 C atoms, a linear or branched, non-halogenated, partially or completely halogenated alkoxy group having 1 to 20 C atoms and a linear or branched, non-halogenated, partially or completely halogenated thioalkyl group having 1 to 20 C atoms;

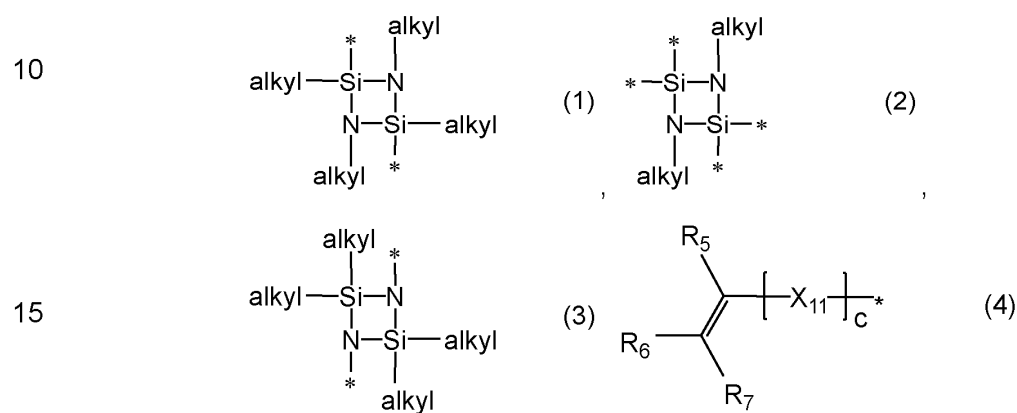
25 R" is at each occurrence independently selected from the group consisting of H, F, Cl, Br, CN, SO₂CF₃, a linear or branched, non-halogenated, partially or completely halogenated alkyl group having 1 to 20 C atoms, a non-halogenated, partially or completely halogenated cycloalkyl group having 3 to 6 C atoms,

30

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a linear or branched, non-halogenated, partially or completely halogenated alkoxy group having 1 to 20 C atoms and a linear or branched, non-halogenated and partially or completely halogenated thioalkyl group having 1 to 20 C atoms;

- 5 R_1 is a trialkoxysilyl group or a dialkoxyalkylsilyl group where the alkyl and/or alkoxy groups are each independently linear or branched having 1 to 6 C atoms, or a silyl group of formula (1), (2) or (3) or a polymerizable group of formula (4),



where alkyl means at each occurrence independently of each other a linear or branched alkyl group having 1 to 6 C atoms and the asterisk "*" denotes at each occurrence independently of each other a linkage to the linker $-R_2-$, $-R_2-Y$ or $[Y-R_2-]_{m1}$; and wherein

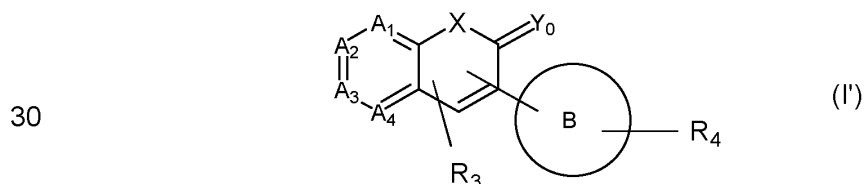
- 20 X_{11} is selected from the group consisting of O, S, O-SO₂, SO₂-O, C(=O), OC(=O), C(=O)O, S(C=O) and (C=O)S,
- 25 R_5 , R_6 , R_7 are at each occurrence independently of each other selected from the group consisting of H, F, a linear or branched, non-fluorinated, partially or completely fluorinated alkyl group having 1 to 20 C atoms and aryl with 6 to 14 C atoms and
- 30 c is 0 or 1;
- $-R_2-$ is $-(C(R)_2)_o-$, or $-(C(R)_2)_p-X_8-(C(R)_2)_q-(X_9)_s-(C(R)_2)_t-(X_{10})_l-(C(R)_2)_u-$;

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R is at each occurrence independently selected from the group consisting of H, F, a linear or branched alkyl group having 1 to 4 C atoms or a linear or branched partially or fully fluorinated alkyl group having 1 to 4 C atoms;

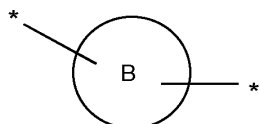
- 5 o is selected from the group consisting of 0 to 20,
 X_8, X_9, X_{10} are at each occurrence independently O, S, SO_2 , or NR_0 ,
 s, t is 0 or 1,
 p, q are at each occurrence independently selected from the
 10 group consisting of 1 to 10,
 r, u are at each occurrence independently selected from the group consisting of 0 to 10, wherein the overall number of atoms for $-(C(R)_2)_p-X_8-(C(R)_2)_q-(X_9)_s-(C(R)_2)_r-(X_{10})_t-(C(R)_2)_u-$ is up to 20 atoms,
 15 R_0 is at each occurrence independently selected from the group consisting of a linear or branched alkyl group having 1 to 4 C atoms and a linear or branched partially or fully fluorinated alkyl group having 1 to 4 C atoms;
 R_3 is H, F, Cl, Br, CN or a linear or branched, non-halogenated, partially or completely halogenated alkyl
 20 group having 1 to 20 C atoms;
 R_4 is R' in case m1 is 0 and
 R_4 is R_1 in case m1 is 1.

- 25 2. The ophthalmic device or the precursor article for manufacturing an ophthalmic device according to claim 1 wherein in polymerized compounds of formula (I) m1 is 0 said compounds being of formula (I')



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wherein R_1 , $-R_2-$, Y , R_3 , X , Y_0 , R' , R'' and



5

have a meaning as indicated in claim 1 and

A_1 , A_2 , A_3 , A_4 are each independently of each other N , CR'' or $C-Y-R_2-R_1$, provided that only one of A_1 , A_2 , A_3 and A_4 is N , only one of A_1 , A_2 , A_3 and A_4 is $C-Y-R_2-R_1$ and the others are each independently CR'' ;

or

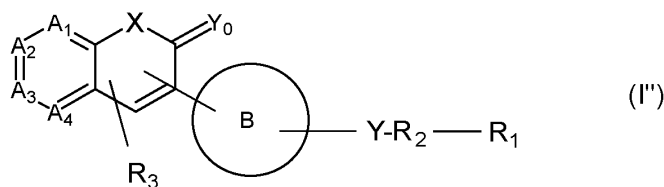
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adjacent A_1-A_2 , A_2-A_3 or A_3-A_4 are each independently of each other $-N(R_2-R_1)-C(=O)-$ or $-C(=O)-N(R_2-R_1)-$ and the remaining A_3 , A_4 , A_1 and A_2 are each independently of each other CR'' ; and R_4 is H or R' .

15

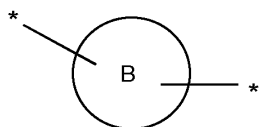
3. The ophthalmic device or the precursor article for manufacturing an ophthalmic device according to claim 1 wherein in polymerized compounds of formula (I) and m_1 is 1 said compounds being of formula (I')

20



wherein R_1 , $-R_2-$, Y , R_3 , X , Y_0 , R' , R'' and

25

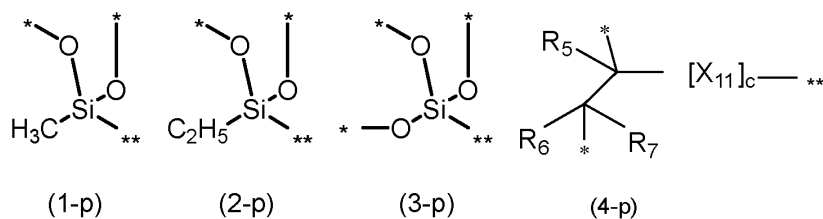


have a meaning as indicated in claim 1 and

A_1 , A_2 , A_3 , A_4 are each independently of each other N or CR'' provided that only one of A_1 , A_2 , A_3 and A_4 is N and the others are CR'' .

30

4. The ophthalmic device or the precursor article for manufacturing an ophthalmic device according to one or more of claims 1 to 3 comprising an oligomer, polymer or copolymer comprising a constitutional unit M^0 based on formulae (I), (I') or (I'') where R_1 on each occurrence is polymerized, R_1 thus forms the regioregular, alternated, regiorandom, statistical, block or random oligomer or polymer backbone or is part of the copolymer backbone.
5. The ophthalmic device or the precursor article for manufacturing an ophthalmic device according to one or more of claims 1 to 4 where said polymerized group R_1 is of formulae (1-p), (2-p), (3-p) or (4-p)



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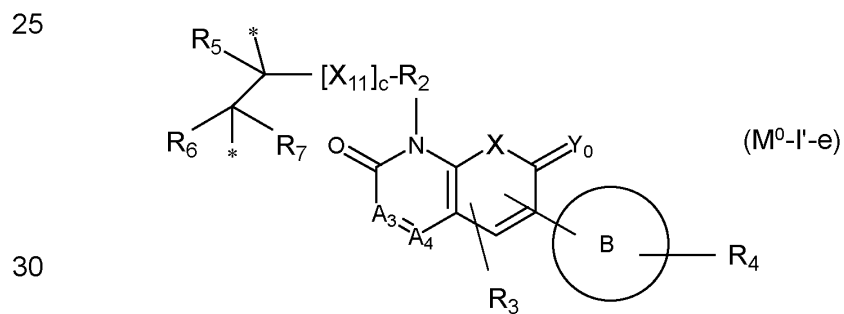
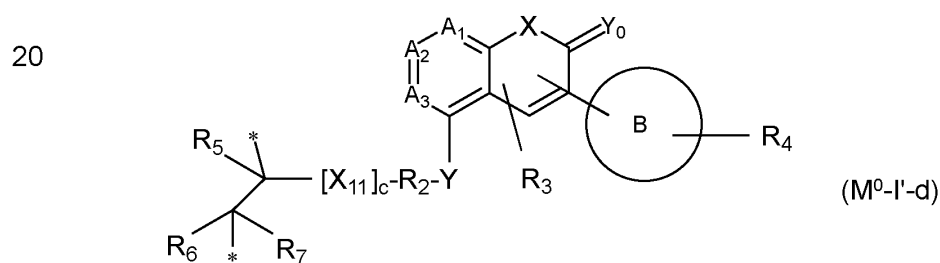
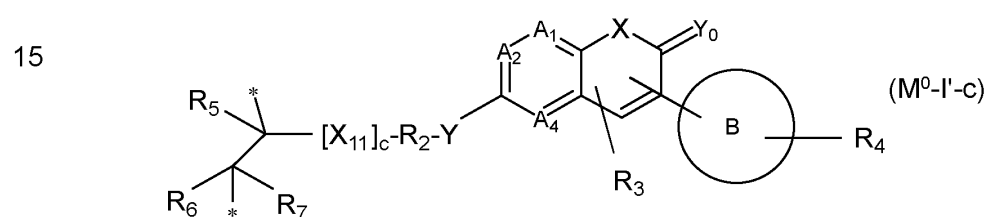
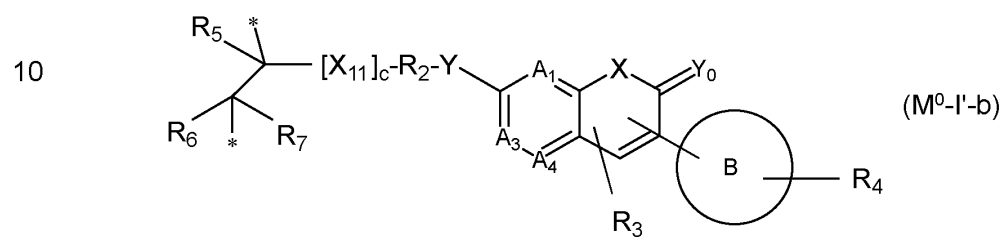
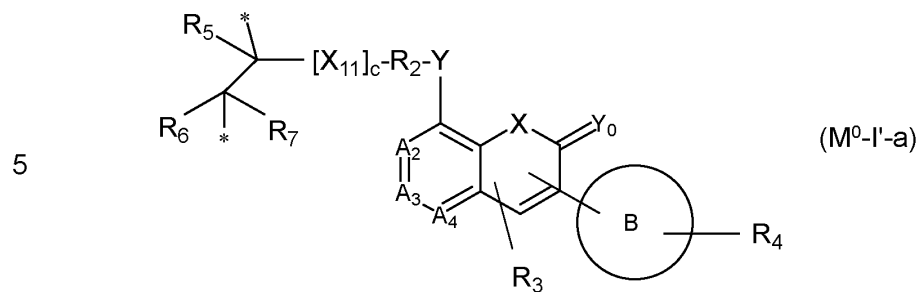
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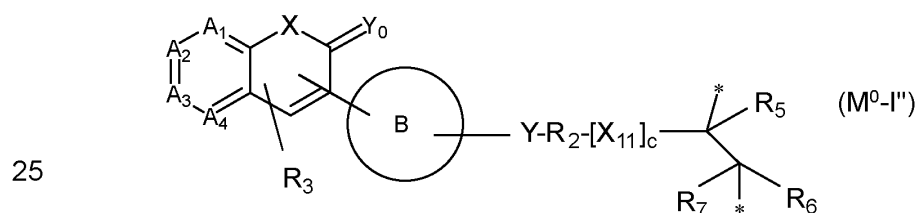
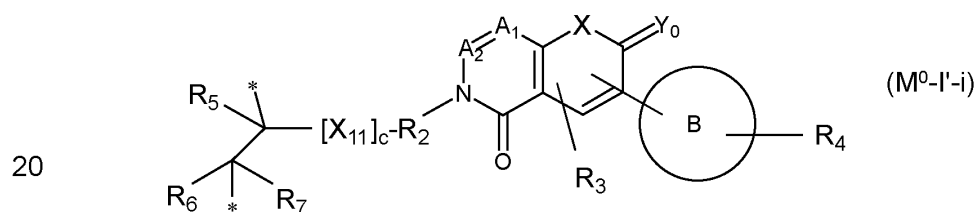
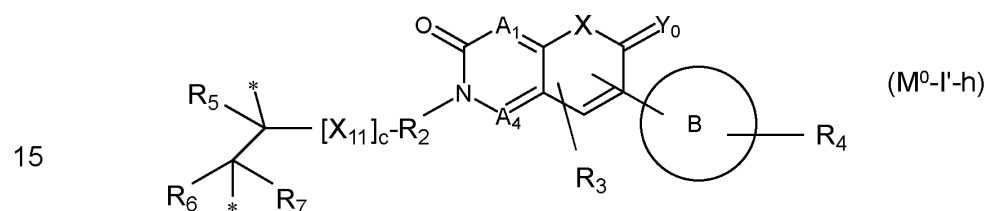
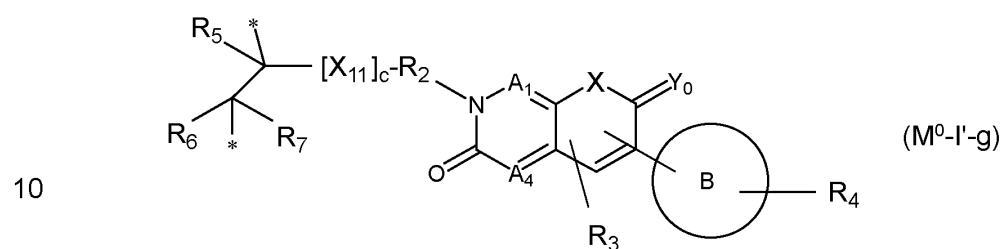
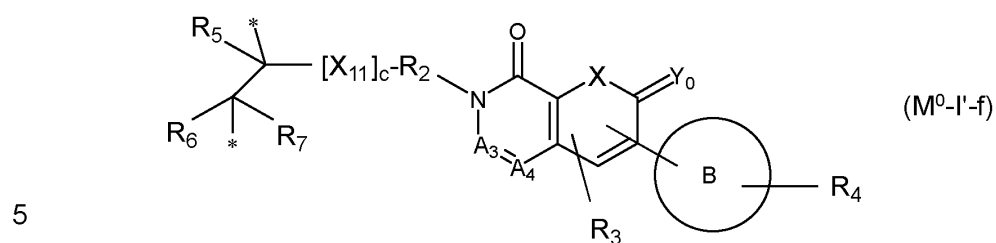
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- where the asterisk “*” within formulae (1-p) to (4-p) denotes a linkage to the adjacent repeating unit in the polymer chain or oligomer chain or to a terminal end group, the asterisk “**” within formulae (1-p) to (4-p) denotes the linkage to the remainder of formulae (I), (I') or (I'') and R_5 , R_6 , R_7 , X_{11} and c has a meaning according to claim 1.
6. The ophthalmic device or the precursor article for manufacturing an ophthalmic device according to one or more of claims 1 to 5 wherein the constitutional unit M^0 is of formulae (M^0 -I'-a), (M^0 -I'-b), (M^0 -I'-c), (M^0 -I'-d),

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 $(M^0-I'-e)$, $(M^0-I'-f)$, $(M^0-I'-g)$, $(M^0-I'-h)$, $(M^0-I'-i)$ or (M^0-I'') ,



30

where R₁, -R₂-, X, Y₀, Y, A₁, A₂, A₃, A₄, R₃, R₄, R₅, R₆, R₇, X₁₁, c and

have a meaning according to claim 1 and R₄ is R' and where the asterisk "*" denotes at each occurrence a linkage to the

adjacent repeating unit in the polymer chain or oligomer chain or to a terminal end group.

- 5 7. The ophthalmic device or the precursor article for manufacturing an ophthalmic device according to one or more of claims 1 to 6 comprising beside of the at least one polymerized compound of formulae (I), (I') or (I'') or the constitutional unit M^0 of formulae (M^0 -I'-a), (M^0 -I'-b), (M^0 -I'-c), (M^0 -I'-d), (M^0 -I'-e), (M^0 -I'-f), (M^0 -I'-g), (M^0 -I'-h), (M^0 -I'-i) or (M^0 -I'') at least one further polymerized monomer selected from the group consisting of

10 styrene, ethoxyethyl methacrylate (EOEMA), methyl methacrylate (MMA), methyl acrylate, n-alkyl acrylates (the n-alkyl group comprising 2-20 C-atoms), n-alkyl methacrylates (the n-alkyl group comprising 2-20 C-atoms), i-alkyl acrylates (the i-alkyl group comprising 3-20 C-atoms), i-alkyl methacrylates (the i-alkyl group comprising 3-20 C-atoms), ethoxyethoxy ethylacrylate (EEEEA), 2-hydroxyethyl methacrylate (HEMA), tetrahydrofuryl methacrylate (THFMA), glycidylmethacrylate (GMA), 16-hydroxyhexadecyl acrylate, 16-hydroxyhexadecyl methacrylate, 18-hydroxyoctadecyl acrylate, 18-hydroxyoctadecyl methacrylate, 2-phenoxyethyl acrylate (EGPEA),

20 heptafluorobutyl acrylate, heptafluorobutyl methacrylate, hexafluorobutyl acrylate, hexafluorobutyl methacrylate, hexafluoroisopropyl acrylate, hexafluoroisopropyle methacrylate, octafluoropentyl acrylate, octafluoropentyl methacrylate, petanfluoropropyl acrylate, pentafluoropropyl methacrylate, tetrafluoropropyl methacrylate, trifluoroethyl acrylate, trifluoroethyl methacrylate, Bisphenol A diacrylate-1 EO/Phenol (BPADA), 2-[3'-2'H-benzotriazol-2'-yl)-4'-hydroxyphenyl]ethyl methacrylate (BTPPEM) or ethyleneglycoldimethacrylate.
- 30 8. The ophthalmic device or the precursor article for manufacturing an ophthalmic device according to claim 7 wherein the at least one further polymerized monomer is selected from methyl methacrylate, 2-

hydroxyethyl methacrylate, 2-phenoxyethyl acrylate, ethoxyethoxy ethylacrylate, 8-methylnonyl methacrylate, *n*-butyl methacrylate, 2-ethyl hexylmethacrylate or a mixture thereof.

- 5 9. The ophthalmic device or the precursor article for manufacturing an ophthalmic device according to one or more of claims 1 to 8 wherein -
R₂- is at each occurrence independently -(C(R)₂)_o- and R and o have a meaning as indicated in claim 1.
- 10 10. The ophthalmic device or the precursor article for manufacturing an ophthalmic device according to one or more of claims 1 to 9 wherein X is O and Y₀ is O.
- 15 11. The ophthalmic device or the precursor article for manufacturing an ophthalmic device according to one or more of claims 1 to 10 wherein polymerized R₁ is at each occurrence independently derived from an acryl or methacryl radical.
- 20 12. The precursor article for manufacturing an ophthalmic device according to one or more of claims 1 to 11 wherein said precursor article is a blank which may be transformed into an eye implant, preferably an intraocular lens.
- 25 13. Process of forming an ophthalmic device or a precursor article for manufacturing an ophthalmic device according to one or more of claims 1 to 12, said process comprising the steps of
- providing a composition comprising at least one compound of formulae (I), (I') or (I'') as described in one or more of claims 1 to 3, 9 and 10 and/or an oligomer or polymer as described in one or more of claims 4 to 8 and 11 but having at least one reactive group left for polymerization
30 and optionally further monomers different from compounds of formulae (I), (I') or (I'') and/or crosslinking agents and/or UV absorbers and/or

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radical initiators;

- subsequently forming the ophthalmic device or precursor article of said composition.

- 5 14. Process of changing the optical properties of an ophthalmic device or a precursor article for manufacturing an ophthalmic device according to one or more of claims 1 to 12, said process comprising the steps of
- providing an ophthalmic device or a precursor article according to claim 13, and
- 10 - subsequently exposing said ophthalmic device or said precursor article to irradiation having a wavelength of at least 200 nm and at most 1500 nm.
- 15 15. Ophthalmic device or precursor article for manufacturing an ophthalmic device obtainable by the process according to claim 14.
16. Oligomer, polymer or copolymer comprising at least one polymerized compound of formula (I) as described in claim 1.
- 20 17. Polymer according to claim 16 comprising beside of the polymerized compounds of formula (I) at least one further polymerized monomer selected from the group consisting of styrene, ethoxyethyl methacrylate (EOEMA), methyl methacrylate (MMA), methyl acrylate, n-alkyl acrylates (the n-alkyl group comprising 2-20 C-atoms), n-alkyl
- 25 methacrylates (the n-alkyl group comprising 2-20 C-atoms), i-alkyl acrylates (the i-alkyl group comprising 3-20 C-atoms), i-alkyl methacrylates (the i-alkyl group comprising 3-20 C-atoms), ethoxyethoxy ethylacrylate (EEEE), 2-hydroxyethyl methacrylate (HEMA), tetrahydrofuryl methacrylate (THFMA), glycidylmethacrylate (GMA), 16-hydroxyhexadecyl acrylate, 16-hydroxyhexadecyl
- 30 methacrylate, 18-hydroxyoctadecyl acrylate, 18-hydroxyoctadecyl methacrylate, 2-phenoxyethyl acrylate (EGPEA), heptafluorobutyl

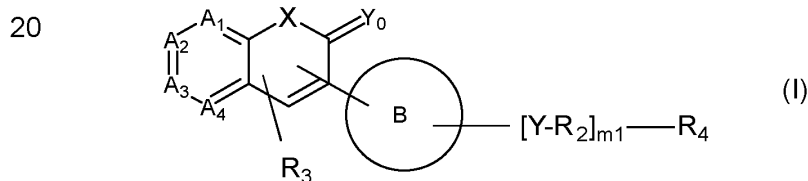
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acrylate, heptafluorobutyl methacrylate, hexafluorobutyl acrylate,
 hexafluorobutyl methacrylate, hexafluoroisopropyl acrylate,
 hexafluoroisopropyle methacrylate, octafluoropentyl acrylate,
 octafluoropentyl methacrylate, petanfluoropropyl acrylate,
 5 pentafluoropropyl methacrylate, tetrafluoropropyl methacrylate,
 trifluoroethyl acrylate, trifluoroethyl methacrylate, Bisphenol A diacrylate-
 1 EO/Phenol (BPADA), 2-[3'-2'H-benzotriazol- 2'-yl)-4'-
 hydroxyphenyl]ethyl methacrylate (BTPEM) or
 ethyleneglycoldimethacrylate.

10

18. Composition for polymerization comprising at least one compound of
 formulae (I), (I') or (I'') as described in one or more of claims 1 to 3, 9
 and 10 and/or an oligomer or polymer according to claim 16 or 17
 having at least one reactive group left for polymerization and/or a
 15 crosslinking agent and/or a UV absorber and/or a radical initiator and
 optionally further monomers different from compounds of formulae (I),
 (I') or (I'').

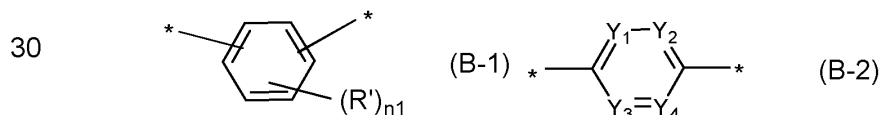
19. Compounds of formula (I)



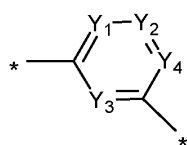
wherein

25

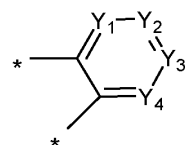
the divalent group is selected from the group of
 formulae (B-1), (B-2), (B-3), (B-4) or (B-5)



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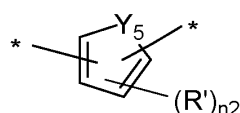


(B-3)



(B-4)

5



(B-5)

the asterisk * indicates the linkage to the remainder of formula (I);

Y_1, Y_2, Y_3, Y_4 are each independently of each other CR' or N, provided

10

that only one of Y_1, Y_2, Y_3 and Y_4 is N and the others are CR';

Y_5 is O, S or NR_B ;

R_B is at each occurrence independently selected from a linear or branched alkyl group having 1 to 10 C atoms or a linear or

15

branched partially or fully fluorinated alkyl group having 1 to 10 C atoms;

A_1, A_2, A_3, A_4 are each independently of each other N, CR'' or C-Y-R₂-R₁, provided that in case m_1 is 1 only one of A_1, A_2 and A_3 is N

and the others and A_4 are CR'' and provided that in case m_1 is 0,

20

only one of A_1, A_2 and A_3 is N, only one of A_1, A_2, A_3 and A_4 is C-Y-R₂-R₁ and the others are each independently CR'';

or

in case of m_1 is 0, adjacent A_1 - A_2 , A_2 - A_3 or A_3 - A_4 are each

independently of each other -N(R₂-R₁)-C(=O)- or -C(=O)-N(R₂-

25

R₁)- and the remaining A_3, A_4, A_1 and A_2 are each independently of each other CR'';

Y is independently of each other O, S, SO₂, or a bond;

m_1 is 0 or 1;

n_1 is 4;

30

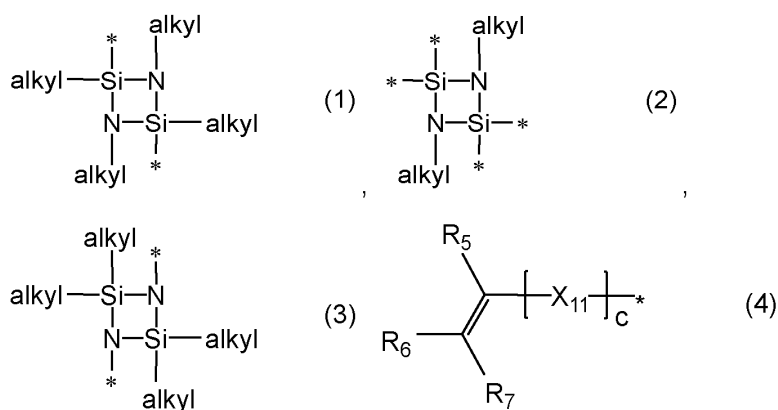
n_2 is 2;

R' is at each occurrence independently selected from the group consisting of H, F, SF₅, CN, SO₂CF₃, a linear or branched, non-

halogenated, partially or completely halogenated alkyl group
 having 1 to 20 C atoms, a non-halogenated, partially or
 completely halogenated cycloalkyl group having 3 to 6 C atoms,
 a linear or branched, non-halogenated, partially or completely
 halogenated alkoxy group having 1 to 20 C atoms and a linear or
 branched, non-halogenated, partially or completely halogenated
 thioalkyl group having 1 to 20 C atoms;

R'' is at each occurrence independently selected from the group
 consisting of H, F, Cl, Br, CN, SO₂CF₃, a linear or branched,
 non-halogenated, partially or completely halogenated alkyl group
 having 1 to 20 C atoms, a non-halogenated, partially or
 completely halogenated cycloalkyl group having 3 to 6 C atoms,
 a linear or branched, non-halogenated, partially or completely
 halogenated alkoxy group having 1 to 20 C atoms and a linear or
 branched, non-halogenated and partially or completely
 halogenated thioalkyl group having 1 to 20 C atoms;

R₁ is a trialkoxysilyl group or a dialkoxyalkylsilyl group where the
 alkyl and/or alkoxy groups are each independently linear or
 branched having 1 to 6 C atoms, or a silyl group of formula (1),
 (2) or (3) or a polymerizable group of formula (4),



where alkyl means at each occurrence independently of each
 other a linear or branched alkyl group having 1 to 6 C atoms and
 the asterisk "*" denotes at each occurrence independently of

each other a linkage to the linker $-R_2-$, $-R_2-Y$ or $[Y-R_2]_{m1}$;

and wherein

X_{11} is selected from the group consisting of O, S, O-SO₂, SO₂-O, C(=O), OC(=O), C(=O)O, S(C=O) and (C=O)S,

5 R_5 , R_6 , R_7 are at each occurrence independently of each other selected from the group consisting of H, F, a linear or branched, non-fluorinated, partially or completely fluorinated alkyl group having 1 to 20 C atoms and aryl with 6 to 14 C atoms and

10 c is 0 or 1;

$-R_2-$ is $-(C(R)_2)_o-$, or $-(C(R)_2)_p-X_8-(C(R)_2)_q-(X_9)_s-(C(R)_2)_r-(X_{10})_t-(C(R)_2)_u-$;

R is at each occurrence independently selected from the group consisting of H, F, a linear or branched alkyl group having 1 to 4 C atoms or a linear or branched partially or fully fluorinated alkyl group having 1 to 4 C atoms;

15 o is 0 to 20,

X_8 , X_9 , X_{10} are at each occurrence independently O, S, SO₂, or NR₀,

20 s , t is 0 or 1,

p , q are at each occurrence independently selected from the group consisting of 1 to 10,

r , u are at each occurrence independently selected from the group consisting of 0 to 10, wherein the overall number of atoms for $-(C(R)_2)_p-X_8-(C(R)_2)_q-(X_9)_s-(C(R)_2)_r-(X_{10})_t-(C(R)_2)_u-$ is up to 20 atoms,

25 R_0 is at each occurrence independently selected from the group consisting of a linear or branched alkyl group having 1 to 4 C atoms and a linear or branched partially or fully fluorinated alkyl group having 1 to 4 C atoms;

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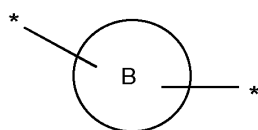
R₃ is H, F, Cl, Br, CN or a linear or branched, non-halogenated, partially or completely halogenated alkyl group having 1 to 20 C atoms;

R₄ is R' in case m₁ is 0;

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R₄ is R₁ in case m₁ is 1 and

provided that in case of m₁ is 0, Y is O or S, A₂ is C-Y-R₂-R₁,

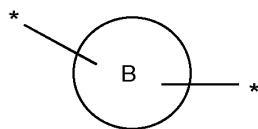


10

the divalent group is in position 3 and is selected from formulae (B-3) and (B-4) where Y₄ within formula (B-3) is N and where Y₃ in formula (B-4) is N, c is 1;

provided that in case of m₁ is 1, A₂ is CR'' and R'' is a linear or branched, non-halogenated, partially or completely halogenated alkoxy group having 1 to 20 C atoms and a linear or branched, non-halogenated and partially or completely halogenated thioalkyl group having 1 to 20 C atoms,

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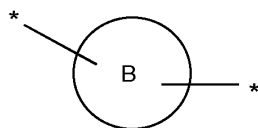


20

the divalent group is in position 3 and is selected from formula (B-3), Y₂ within formula (B-3) is CR' and R' is H, Y₄ within formula (B-3) is N, and Y is a bond, O or S, c is 1;

provided that in case of m₁ is 1, Y is a bond, c is 0, R₃ is Cl and

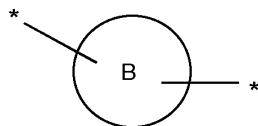
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the divalent group is in position 3, o is 5 to 20;

provided that in case of m₁ is 0, Y is a bond or O, c is 0, R₃ is Cl and

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the divalent group is in position 3, o is 7 to 20;

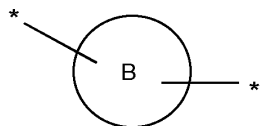
provided that in case of m₁ is 0, X is O, Y₀ is O and Y is a bond, c is 1 and X₁₁ is O, S, O-SO₂, SO₂-O, OC(=O), C(=O)O, S(C=O) and (C=O)S;

provided that in case of m_1 is 1, X is O and Y_0 is O, o is 5 to 20;

provided that in case of m_1 is 1, c is 0, Y is a bond or O and

5

the divalent group

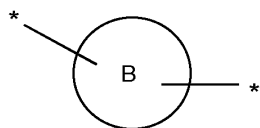


is in position 3, o is 11 to 20;

provided that in case of m_1 is 1, A_1 or A_3 is N, Y is a bond, c is 0,

10

the divalent group

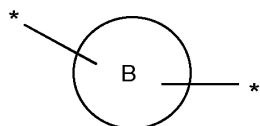


is in position 3, o is 7 to 20 and

provided that in case of m_1 is 0, X is O, Y_0 is O, Y is O or S, c is 0, A_2 is C-Y- R_2 - R_1 , A_3 is Br, A_1 is N,

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the divalent group



is in position 4 and is selected

from formulae (B-1), (B-3) and (B-4), o is 2 to 20.

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