Claims

1. Monomer composition for the preparation of a siloxane oligomer or polymer, comprising:

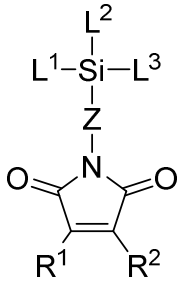
(a) a first siloxane monomer; and

(b) a second siloxane monomer;

wherein the first siloxane monomer comprises a substituted or unsubstituted maleimide group;~~.~~

~~2. Monomer composition according to claim 1,~~

wherein the first siloxane monomer is represented by Formula (1):



Formula (1),

wherein:

L^1, **L^2** and **L^3** are the same or different from each other and each independently is selected from **R**, O**R**, and halogen, wherein at least one of **L^1**, **L^2** and **L^3** is O**R** or halogen;

R is selected from the group consisting of H, straight-chain alkyl having 1 to 30 carbon atoms, branched-chain alkyl having 3 to 30 carbon atoms, cyclic alkyl having 3 to 30 carbon atoms, and aryl having 6 to 20 carbon atoms, wherein one or more non-adjacent and non-terminal CH_2 groups are optionally replaced by -O-, -S-, -C(=O)-, -C(=S)-, -C(=O)-O-, -O-C(=O)-, $-NR^0-$, $-SiR^0R^{00}-$, $-CF_2-$, $-CR^0=CR^{00}-$, $-CY^1=CY^2-$ or -C≡C-, and wherein one or more H atoms are optionally replaced by F;

R^1 and **R^2** are the same or different from each other and each independently is selected from H, alkyl having 1 to 20 carbon atoms,

cycloalkyl having 3 to 20 carbon atoms and aryl having 6 to 20 carbon atoms, wherein one or more H atoms are optionally replaced by F, ~~or **R¹** and **R²** together form a mono- or polycyclic organic ring system,~~ wherein one or more H atoms are optionally replaced by F;

Z denotes a straight-chain alkylene group having 1 to 20 carbon atoms, a branched-chain alkylene group having 3 to 20 carbon atoms or a cyclic alkylene group having 3 to 20 carbon atoms, in which one or more non-adjacent and non-terminal CH_2 groups are optionally replaced by -O-, -S-, -C(=O)-, -C(=S)-, -C(=O)-O-, -O-C(=O)-, $-NR^0-$, $-SiR^0R^{00}-$, $-CF_2-$, $-CR^0=CR^{00}-$, $-CY^1=CY^2-$ or -C≡C-, and in which one or more H atoms are optionally replaced by F;

Y¹ and **Y²** are the same or different from each other and each independently is selected from H, F, Cl and CN;

R⁰ and **R⁰⁰** are the same or different from each other and each independently is selected from H, straight-chain alkyl having 1 to 20 carbon atoms and branched-chain alkyl having 3 to 20 carbon atoms, which are optionally fluorinated;and

wherein the second siloxane monomer is different from the first siloxane monomer.

~~3~~2. Monomer composition according to claim ~~2~~1, wherein one of the conditions (1) or (2) applies:

(1) **L¹** = **L²** = **L³** = O**R**; or

(2) **L¹** = **L²** = **R**, and **L³** = Cl.

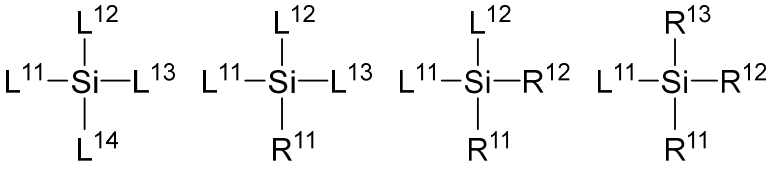
~~4~~3. Monomer composition according to claim ~~2~~ 1 or ~~3~~2,

wherein **R¹** and **R²** are the same or different from each other and each independently is selected from H, alkyl having 1 to 12 carbon atoms, cycloalkyl having 3 to 12 carbon atoms and aryl having 6 to 14 carbon atoms, wherein one or more H atoms are optionally replaced by F, ~~or **R¹** and **R²** together form a mono- or polycyclic aliphatic ring system,~~ a mono- or

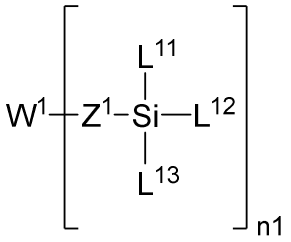
polycyclic aromatic ring system or a polycyclic aliphatic and aromatic ring system, wherein one or more H atoms are optionally replaced by F.

~~5~~4. Monomer composition according to one or more of claims 1 to 4~~3~~,

wherein the second siloxane monomer is represented by one of the following Structures S1 to S5:



S1 , S2 , S3 , S4 , and



S5 ;

wherein:

L^{11}, **L^{12}**, **L^{13}**, and **L^{14}** are the same or different from each other and each independently is selected from O**R'** and halogen;

R' is selected from the group consisting of straight-chain alkyl having 1 to 30 carbon atoms, branched-chain alkyl having 3 to 30 carbon atoms, cyclic alkyl having 3 to 30 carbon atoms, and aryl having 6 to 20 carbon atoms, wherein one or more non-adjacent and non-terminal CH_2 groups are optionally replaced by -O-, -S-, -C(=O)-, -C(=S)-, -C(=O)-O-, -O-C(=O)-, $-NR^0-$, $-SiR^0R^{00}-$, $-CF_2-$, $-CR^0=CR^{00}-$, $-CY^1=CY^2-$ or -C≡C-, and wherein one or more H atoms are optionally replaced by F;

R^{11}, **R^{12}** and **R^{13}** are the same or different from each other and each independently is selected from the group consisting of H, straight-chain alkyl

having 1 to 30 carbon atoms, branched-chain alkyl having 3 to 30 carbon atoms, cyclic alkyl having 3 to 30 carbon atoms, and aryl having 6 to 20 carbon atoms, which optionally contain one or more functional groups selected from -O-, -S-, -C(=O)-, -C(=S)-, -C(=O)-O-, -O-C(=O)-, $-NR^0-$, $-SiR^0R^{00}-$, $-CF_2-$, $-CR^0=CR^{00}-$, $-CR^0=CR^{00}{}_2-$, $-CY^1=CY^2-$, and -C≡C-, and wherein one or more H atoms are optionally replaced by F;

Z^1 denotes a straight-chain alkylene group having 1 to 20 carbon atoms, a branched-chain alkylene group having 3 to 20 carbon atoms or a cyclic alkylene group having 3 to 20 carbon atoms, in which one or more non-adjacent and non-terminal CH_2 groups are optionally replaced by -O-, -S-, -C(=O)-, -C(=S)-, -C(=O)-O-, -O-C(=O)-, $-NR^0-$, $-SiR^0R^{00}-$, $-CF_2-$, $-CR^0=CR^{00}-$, $-CY^1=CY^2-$ or -C≡C-, and in which one or more H atoms are optionally replaced by F;

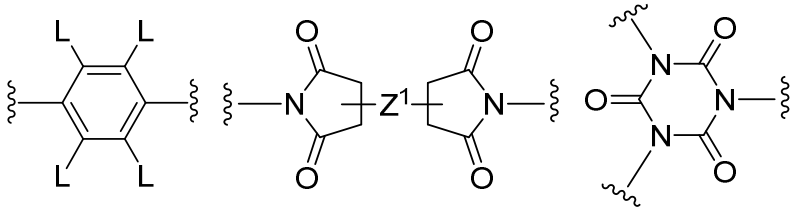
W^1 denotes a divalent, trivalent or tetravalent organic moiety;

R^0, **R^{00}**, **Y^1**, and **Y^2** are defined as in claim 1; and

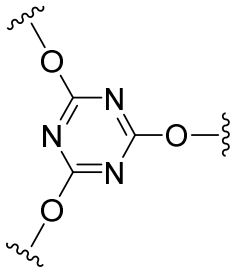
n1 = 2, 3 or 4.

~~6~~5. Monomer composition according to claim ~~5~~4,

wherein **W^1** is represented by one of the following Structures W1 to W4:



W1 , W2 , W3 , and



W4 ;

wherein:

L is selected from H, -F, -Cl, -NO_2, -CN, -NC, -NCO, -NCS, -OCN, -SCN, -OH, -R^0, -OR^0, -SR^0, -C(=O)R^0, -C(=O)-OR^0, -O-C(=O)-R^0, -NH_2, -NHR^0, -NR^0R^{00}, -C(=O)NHR^0, -C(=O)NR^0R^{00}, -SO_3R^0, -SO_2R^0, an alkyl group with 1 to 20 carbon atoms, or an aryl group with 6 to 20 carbon atoms, which may optionally be substituted by -F, -Cl, -NO_2, -CN, -NC, -NCO, -NCS, -OCN, -SCN, -OH, -R^0, -OR^0, -SR^0, -C(=O)-R^0, -C(=O)-OR^0, -O-C(=O)-R^0, -NH_2, -NHR^0, NR^0R^{00}, -O-C(=O)-OR^0, -C(=O)-NHR^0, or -C(=O)-NR^0R^{00}; and

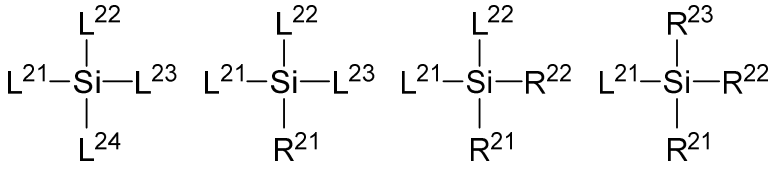
R^0 and **R^{00}** are defined as in claim 1.

~~7~~6. Monomer composition according to one or more of claims 1 to ~~6~~5, further comprising:

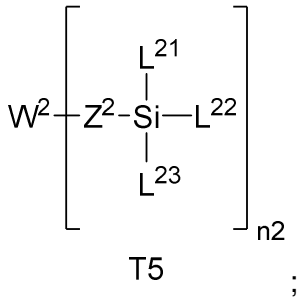
(c) a third siloxane monomer;

wherein the third siloxane monomer is different from the first siloxane monomer and the second siloxane monomer.

~~8~~7. Monomer composition according to claim ~~7~~6, wherein the third siloxane monomer is represented by one of the following Structures T1 to T5:



T1 , T2 , T3 , T4 , and



T5 ;

wherein:

L^{21}, **L^{22}**, **L^{23}**, and **L^{24}** are the same or different from each other and each independently is selected from O**R''** and halogen;

R'' is selected from the group consisting of straight-chain alkyl having 1 to 30 carbon atoms, branched-chain alkyl having 3 to 30 carbon atoms, cyclic alkyl having 3 to 30 carbon atoms, and aryl having 6 to 20 carbon atoms, wherein one or more non-adjacent and non-terminal CH_2 groups are optionally replaced by -O-, -S-, -C(=O)-, -C(=S)-, -C(=O)-O-, -O-C(=O)-, $-NR^0-$, $-SiR^0R^{00}-$, $-CF_2-$, $-CR^0=CR^{00}-$, $-CY^1=CY^2-$ or -C≡C-, and wherein one or more H atoms are optionally replaced by F;

R^{21}, **R^{22}** and **R^{23}** are the same or different from each other and each independently is selected from the group consisting of H, straight-chain alkyl having 1 to 30 carbon atoms, branched-chain alkyl having 3 to 30 carbon atoms, cyclic alkyl having 3 to 30 carbon atoms, and aryl having 6 to 20 carbon atoms, which optionally contain one or more functional groups selected from -O-, -S-, -C(=O)-, -C(=S)-, -C(=O)-O-, -O-C(=O)-, $-NR^0-$, $-SiR^0R^{00}-$, $-CF_2-$, $-CR^0=CR^{00}-$, $-CR^0=CR^{00}{}_2-$, $-CY^1=CY^2-$, and -C≡C-, and wherein one or more H atoms are optionally replaced by F;

Z^2 denotes a straight-chain alkylene group having 1 to 20 carbon atoms, a branched-chain alkylene group having 3 to 20 carbon atoms or a cyclic alkylene group having 3 to 20 carbon atoms, in which one or more non-adjacent and non-terminal CH_2 groups are optionally replaced by -O-, -S-, -C(=O)-, -C(=S)-, -C(=O)-O-, -O-C(=O)-, $-NR^0-$, $-SiR^0R^{00}-$, $-CF_2-$,

$-CR^0=CR^{00}-$, $-CY^1=CY^2-$ or -C≡C-, and in which one or more H atoms are optionally replaced by F;

W^2 denotes a divalent, trivalent or tetravalent organic moiety;

R^0, **R^{00}**, **Y^1**, and **Y^2** are defined as in claim 1; and

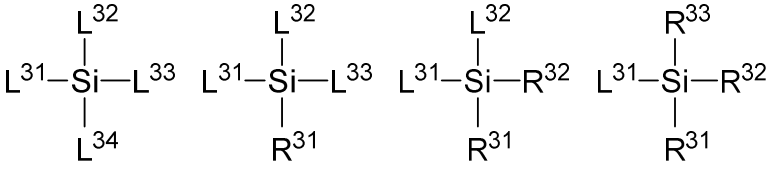
n2 = 2, 3 or 4.

~~9~~8. Monomer composition according to claim ~~7~~ 6 or ~~8~~7, further comprising:

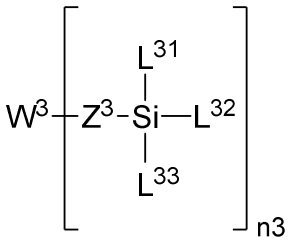
(d) a fourth siloxane monomer;

wherein the fourth siloxane monomer is different from the first siloxane monomer, the second siloxane monomer and the third siloxane monomer.

~~10~~9. Monomer composition according to claim ~~9~~8, wherein the fourth siloxane monomer is represented by one of the following Structures F1 to F5:



F1 , F2 , F3 , F4 , and



F5 ;

wherein:

L^{31}, **L^{32}**, **L^{33}**, and **L^{34}** are the same or different from each other and each independently is selected from O**R'''** and halogen;

R''' is selected from the group consisting of straight-chain alkyl having 1 to 30 carbon atoms, branched-chain alkyl having 3 to 30 carbon atoms, cyclic alkyl having 3 to 30 carbon atoms, and aryl having 6 to 20 carbon atoms, wherein one or more non-adjacent and non-terminal CH_2 groups are optionally replaced by -O-, -S-, -C(=O)-, -C(=S)-, -C(=O)-O-, -O-C(=O)-, $-NR^0-$, $-SiR^0R^{00}-$, $-CF_2-$, $-CR^0=CR^{00}-$, $-CY^1=CY^2-$ or -C≡C-, and wherein one or more H atoms are optionally replaced by F;

$\mathbf{R^{31}}$, $\mathbf{R^{32}}$ and $\mathbf{R^{33}}$ are the same or different from each other and each independently is selected from the group consisting of H, straight-chain alkyl having 1 to 30 carbon atoms, branched-chain alkyl having 3 to 30 carbon atoms, cyclic alkyl having 3 to 30 carbon atoms, and aryl having 6 to 20 carbon atoms, which optionally contain one or more functional groups selected from -O-, -S-, -C(=O)-, -C(=S)-, -C(=O)-O-, -O-C(=O)-, $-NR^0-$, $-SiR^0R^{00}-$, $-CF_2-$, $-CR^0=CR^{00}-$, $-CR^0=CR^{00}{}_2-$, $-CY^1=CY^2-$, and -C≡C-, and wherein one or more H atoms are optionally replaced by F;

$\mathbf{Z^3}$ denotes a straight-chain alkylene group having 1 to 20 carbon atoms, a branched-chain alkylene group having 3 to 20 carbon atoms or a cyclic alkylene group having 3 to 20 carbon atoms, in which one or more non-adjacent and non-terminal CH_2 groups are optionally replaced by -O-, -S-, -C(=O)-, -C(=S)-, -C(=O)-O-, -O-C(=O)-, $-NR^0-$, $-SiR^0R^{00}-$, $-CF_2-$, $-CR^0=CR^{00}-$, $-CY^1=CY^2-$ or -C≡C-, and in which one or more H atoms are optionally replaced by F;

$\mathbf{W^3}$ denotes a divalent, trivalent and tetravalent organic moiety;

$\mathbf{R^0}$, $\mathbf{R^{00}}$, $\mathbf{Y^1}$, and $\mathbf{Y^2}$ are defined as in claim 1; and

n3 = 2, 3 or 4.

~~11~~10. Monomer composition according to one or more of claims 1 to ~~10~~9, wherein the molar ratio between the first siloxane monomer and the entirety of all further siloxane monomers is in the range from 1:0.1 to 1:10.

~~12~~11. Method for preparing a siloxane oligomer or polymer, wherein the method comprises the following steps:

(i) providing a monomer composition according to any one of claims 1 to ~~11~~10; and

(ii) reacting the monomer composition provided in step (i) to obtain a siloxane oligomer or polymer.

~~13~~12. Siloxane oligomer or polymer, obtainable by the method according to claim ~~12~~11.

~~14~~13. Siloxane oligomer or polymer, comprising or consisting of a first repeating unit, wherein the first repeating unit is derived from a first siloxane monomer,

wherein the first siloxane monomer comprises a substituted or unsubstituted maleimide group.

~~15~~14. Siloxane oligomer or polymer according to claim ~~14~~13, comprising a first repeating unit and a second repeating unit,

wherein the first repeating unit is derived from a first siloxane monomer and the second repeating unit is derived from a second siloxane monomer,

wherein the first siloxane monomer comprises a substituted or unsubstituted maleimide group; and

wherein the second siloxane monomer is different from the first siloxane monomer.

~~16~~15. Siloxane oligomer or polymer according to claim ~~15~~14, further comprising a third repeating unit,

wherein the third repeating unit is derived from a third siloxane monomer,

wherein the third siloxane monomer is different from the first siloxane monomer and the second siloxane monomer.

~~17~~16. Siloxane oligomer or polymer according to claim ~~16~~15, further comprising a fourth repeating unit,

wherein the fourth repeating unit is derived from a fourth siloxane monomer,

wherein the fourth siloxane monomer is different from the first siloxane monomer, the second siloxane monomer and the third siloxane monomer.

~~18~~17. Crosslinkable composition comprising one or more siloxane oligomers or polymers according to any one of claims ~~13~~ 12 to ~~17~~16.

~~19~~18. Method for manufacturing a microelectronic structure comprising the following steps:

(1) applying a crosslinkable composition according to claim ~~18~~ 17 to a surface of a substrate; and

(2) curing said crosslinkable composition to form a layer which passivates and optionally planarizes the surface of the substrate.

~~20~~19. Electronic device comprising a microelectronic structure, obtainable by the method for manufacturing according to claim ~~19~~18.

20. Monomer composition according to claim 1, wherein $\mathbf{R^1}$ and $\mathbf{R^2}$ are $-CH_3$.