Claims

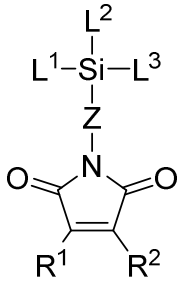
1. Monomer composition for the preparation of a siloxane oligomer or polymer, comprising:

(a) a first siloxane monomer; and

(b) a second siloxane monomer;

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

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, 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;

$\mathbf{Y^1}$ and $\mathbf{Y^2}$ are the same or different from each other and each independently is selected from H, F, Cl and CN;

$\mathbf{R^0}$ and $\mathbf{R^{00}}$ 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.

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

(1) $\mathbf{L^1} = \mathbf{L^2} = \mathbf{L^3} = O\mathbf{R}$; or

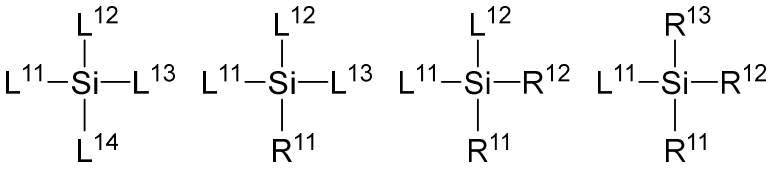
(2) $\mathbf{L^1} = \mathbf{L^2} = \mathbf{R}$, and $\mathbf{L^3}$ = Cl.

3. Monomer composition according to claim 1 or 2,

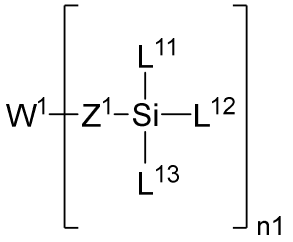
wherein $\mathbf{R^1}$ and $\mathbf{R^2}$ are the same or different from each other and each independently is selected from H, alkyl having 1 to 12 carbon atoms, cycloalkyl having 3 to 12 carbon atoms and aryl having 6 to 14 carbon atoms, wherein one or more H atoms are optionally replaced by F, a mono- or polycyclic aromatic ring system or a polycyclic aliphatic and aromatic ring system, wherein one or more H atoms are optionally replaced by F.

4. Monomer composition according to one or more of claims 1 to 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;

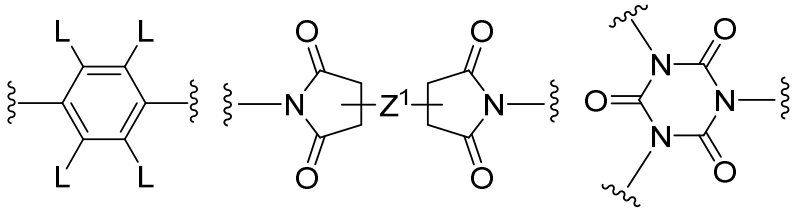
W^1 denotes a divalent, trivalent or tetravalent organic moiety;

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

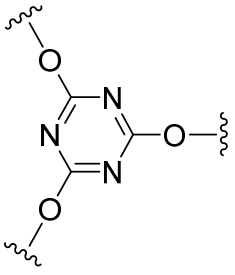
n1 = 2, 3 or 4.

5. Monomer composition according to claim 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

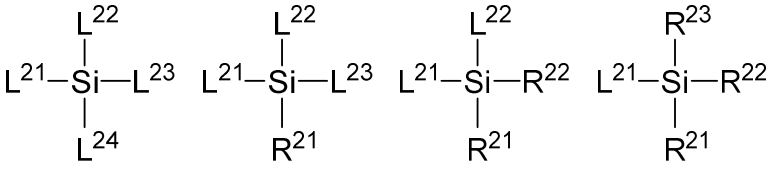
R^0 and **R^{00}** are defined as in claim 1.

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

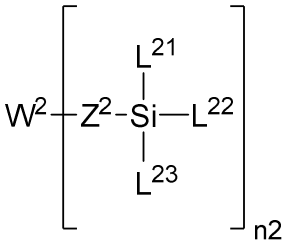
(c) a third siloxane monomer;

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

7. Monomer composition according to claim 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

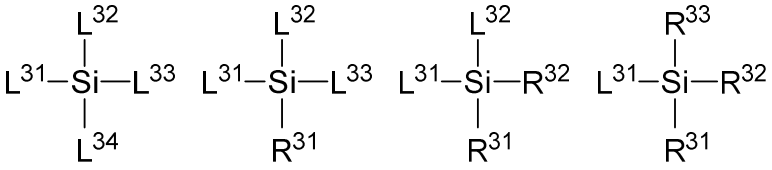
n2 = 2, 3 or 4.

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

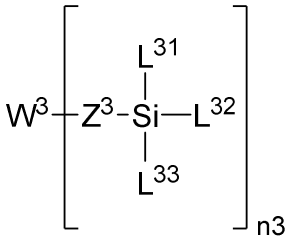
(d) a fourth siloxane monomer;

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

9. Monomer composition according to claim 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;

R^{31}, **R^{32}** and **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;

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;

W^3 denotes a divalent, trivalent and tetravalent organic moiety;

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

n3 = 2, 3 or 4.

10. Monomer composition according to one or more of claims 1 to 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.

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 10; and

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

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

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.

14. Siloxane oligomer or polymer according to claim 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.

15. Siloxane oligomer or polymer according to claim 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.

16. Siloxane oligomer or polymer according to claim 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.

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

18. Method for manufacturing a microelectronic structure

comprising the following steps:

(1) applying a crosslinkable composition according to claim 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.

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

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