Claims

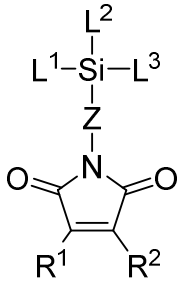
1. Monomer composition for the preparation of a siloxane oligomer or polymer, comprising:

(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**;

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;

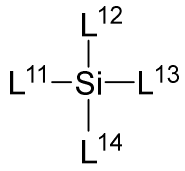
R^1 and **R^2** are the same or different from each other and each independently is selected from H, alkyl having 1 to 20 carbon atoms, cycloalkyl having 3 to 20 carbon atoms and aryl having 6 to 20 carbon atoms, wherein one or more H atoms are optionally replaced by F;

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 represented by the following Structure S1:



S1

wherein L^{11}, L^{12}, L^{13}, and L^{14} are the same or different from each other and each is independently OR'; and

R' is a straight-chain alkyl having 1 to 30 carbon atoms; and

(c) a third siloxane monomer;

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

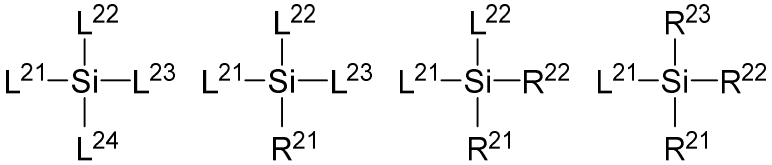
2. Monomer composition according to claim 1, wherein the condition (1) applies:

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

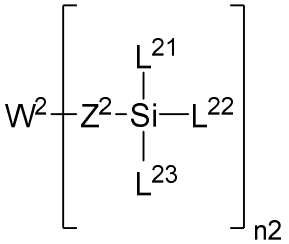
3. Monomer composition according to claim 1 or 2,

wherein **R^1** and **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 any one of claims 1 to 3, 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

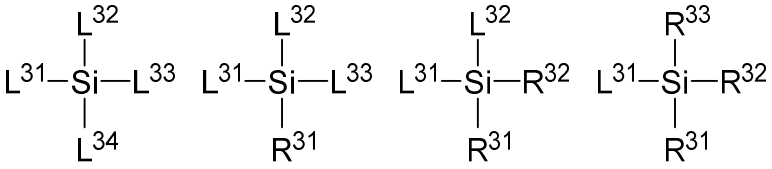
n2 = 2, 3 or 4.

5. Monomer composition according to any one of claims 1 to 4, further comprising:

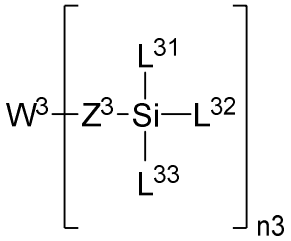
(d) a fourth siloxane monomer;

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

6. Monomer composition according to claim 5, 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.

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

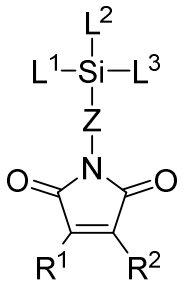
(i) providing a monomer composition according to any one of claims 1 to 6; and

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

8. Siloxane oligomer or polymer comprising a first repeating unit, a second repeating unit, a third repeating unit, and a fourth repeating unit,

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

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**;

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;

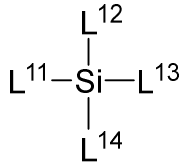
R^1 and **R^2** are the same or different from each other and each independently is selected from H, alkyl having 1 to 20 carbon atoms, cycloalkyl having 3 to 20 carbon atoms and aryl having 6 to 20 carbon atoms, wherein one or more H atoms are optionally replaced by F;

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;

Y^1 and **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 represented by the following Structure S1:



S1

wherein L^{11}, L^{12}, L^{13}, and L^{14} are the same or different from each other and each is independently OR'; and

R' is a straight-chain alkyl having 1 to 30 carbon atoms; and

wherein the first siloxane monomer, the second siloxane monomer, the third siloxane monomer and the fourth siloxane monomer are different from each other.

9. Crosslinkable composition comprising one or more siloxane oligomers or polymers according to claim 8.

10. Method for manufacturing a microelectronic structure

comprising the following steps:

(1) applying a crosslinkable composition according to claim 9 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.

11. Electronic device comprising a microelectronic structure, obtainable by the method for manufacturing according to claim 10.

12. Monomer composition according to claim 1, wherein **R^1** and **R^2** are -CH_3.