

Claims

1. A method for preparing hydridosilane oligomers, comprising:
 reacting a hydridosilane composition (I) comprising at least one linear
 hydridosilane $\text{Si}_n\text{H}_{2n+2}$ with $n \geq 2$ in the presence of a branched
 hydridosilane compound (II),
 wherein the branched hydridosilane compound (II) comprises at least one
 quaternary silicon atom $\text{Si}(\text{SiR}_3)_4$, wherein R is chosen from the group
 consisting of H; $\text{Si}_n\text{H}_{2n+1}$ with $n \geq 1$; Si_mH_{2m} with $m \geq 2$; and $\text{Si}_j\text{H}_{2j-1}$ with
 $j \geq 3$.
2. The method according to claim 1, wherein the branched hydridosilane
 compound (II) is present in a range of 0.05 to 50 wt.-%, based on the total
 weight of the hydridosilane composition (I) and the branched hydridosilane
 compound (II).
3. The method according to any one of the preceding claims, wherein the
 branched hydridosilane compound (II) is selected from the group consisting
 of neopentasilane, neopentasilane oligomer, 2,2-disilyltetrasilane, 2,2-
 disilylpentasilane, 3,3-disilylpentasilane, 2,2,3-trisilyltetrasilane, 1,1-
 disilylcyclopentasilane, 2,2,3,3-tetrasilyltetrasilane, 2,2,3-trisilylpentasilane,
 2,2,4-trisilylpentasilane, 2,2-disilylhexasilane, 3,3-disilylhexasilane, 1,1-
 disilylcyclohexasilane, 1,1,2-trisilylcyclopentasilane, 1,1,3-
 trisilylcyclopentasilane, 2,2-disilylheptasilane, 3,3-disilylheptasilane, 4,4-
 disilylheptasilane, 2,2,3-trisilylheptasilane, 2,2,4-trisilylheptasilane, 2,2,5-
 trisilylheptasilane, 2,3,3-trisilylheptasilane, 3,3,4-trisilylheptasilane, 3,3,5-
 trisilylheptasilane, 3-disilanyl-3-silylhexasilane, 2,2,3,3-
 tetrasilylpentasilane, 2,2,3,4-tetrasilylpentasilane, 2,2,4,4-
 tetrasilylpentasilane, 2,3,3,4-tetrasilylpentasilane, 3-disilanyl-2,2-
 disilylpentasilane, 3,3-bis(disilanyl)pentasilane, 1,1,2-
 trisilylcyclohexasilane, 1,1,3-trisilylcyclohexasilane, 1,1,4-
 trisilylcyclohexasilane, 1,1,2,2-tetrasilylcyclohexasilane, 1,1,3,3-
 tetrasilylcyclohexasilane, 1,1,4,4-tetrasilylcyclohexasilane, 1,1,2,3-
 tetrasilylcyclohexasilane, 1,1,2,4-tetrasilylcyclohexasilane, 1,1,3,4-
 tetrasilylcyclohexasilane and mixtures thereof, preferably from the group

consisting of neopentasilane, neopentasilane oligomer, and mixtures thereof.

4. The method according to any one of the preceding claims, wherein the
5 hydridosilane composition (I) is reacted in the presence of the branched hydridosilane compound (II) in the absence of a catalyst and/or wherein the reaction is solvent free.
5. The method according to any one of the preceding claims, wherein the
10 hydridosilane composition (I) comprises at least one linear hydridosilane $\text{Si}_n\text{H}_{2n+2}$, wherein n is 2 to 9.
6. The method according to any one of the preceding claims, wherein the
15 hydridosilane composition (I) is reacted in the presence of the branched hydridosilane compound (II) at a temperature in the range of 50 °C to 300 °C and by irradiating with electromagnetic radiation, preferably in the visible spectral range.
7. The method according to any one of the preceding claims, wherein the
20 hydridosilane composition (I) comprises hydridosilane mixtures having a mass average molecular weight of M_w in the range of 200 to 5000 g/mol, preferably 1000 to 3000 g/mol, measured by gel permeation chromatography (GPC) and/or wherein the neopentasilane oligomer (II)
25 has a mass average molecular weight of M_w in the range of 500 to 5000 g/mol, preferably 1500 to 3500 g/mol measured by gel permeation chromatography (GPC).
8. The method according to any one of the preceding claims, wherein the
30 branched hydridosilane compound (II) consists of 80 to 98 wt.-% of neopentasilane and 2 to 20 wt.-% of a neopentasilane oligomer, preferably of 85 to 94 wt.-% of neopentasilane and 6 to 15 wt.-% of a neopentasilane oligomer, more preferably of 90 to 92 wt.-% of neopentasilane and 8 to 10 wt.-% of a neopentasilane oligomer, based on the total weight of the branched hydridosilane compound (II).

9. The method according to any one of the preceding claims, wherein at least one dopant selected from the group consisting of
BH_xR_{3-x}, wherein x = 0 – 3 and R = C₁-C₁₀-alkyl radical, unsaturated cyclic,
5 optionally ether- or amino-complexed C₂-C₁₀-alkyl radical;
Si₅H₉BR₂, wherein R = H, Ph, or C₁-C₁₀-alkyl radical;
Si₄H₉BR₂, wherein R = H, Ph, or C₁-C₁₀-alkyl radical;
red phosphorous;
white phosphorous (P₄);
10 PH_xR_{3-x}, wherein x = 0 – 3 and R = Ph, SiMe₃, or C₁-C₁₀-alkyl radical;
P₇(SiR₃)₃, wherein R = H, Ph, or C₁-C₁₀-alkyl radical;
Si₅H₉PR₂, wherein R = H, Ph, or C₁-C₁₀-alkyl radical; and
Si₄H₉PR₂, wherein R = H, Ph, or C₁-C₁₀-alkyl radical
is added before, during or after the reaction.
- 15
10. A hydridosilane oligomer obtainable by the method according to any one of the preceding claims.
11. The hydridosilane oligomer according to claim 10, wherein the
20 hydridosilane oligomer has a mass average molecular weight of M_w in the range of 500 to 5000 g/mol, measured by gel permeation chromatography (GPC).
12. A method for preparing a coating composition comprising:
25 (i) preparing hydridosilane oligomers according to the method according to any of claims 1 to 9; and
(ii) diluting the hydridosilane oligomers with an organic solvent, preferably with an organic solvent selected from the group consisting of toluene and cyclooctane.
- 30
13. The method according to claim 12, wherein the coating composition comprises 0.1 to 99 wt.-%, more preferably 10 to 97 wt.-%, most preferably 25 to 95 wt.-%, and in particular 60 to 80 wt.-% of the organic solvent,

based on the total weight of the hydridosilane oligomer and the organic solvent.

14. A method for preparing a silicon-containing layer, comprising:
 - 5 (a) preparing hydridosilane oligomers according to the method according to any of claims 1 to 9;
 - (b) optionally diluting the hydridosilane oligomers with an organic solvent, preferably with an organic solvent selected from the group consisting of toluene and cyclooctane;
 - 10 (c) applying the hydridosilane oligomer formulation on a substrate; and
 - (d) converting the hydridosilane oligomer formulation into amorphous silicon.
- 15 15. The method according to claim 14, wherein the application step (c) is carried out by printing, spraying, aerosol assisted chemical vapor deposition, direct liquid injection chemical vapor deposition, spin-coating, dip-coating, meniscus coating, slit coating, slot-die coating and curtain coating; and/or
wherein the conversion step (d) is carried out thermally and/or by using
20 electromagnetic radiation and/or by electron ion bombardment.
16. A use of hydridosilane oligomers obtained by the method according to any one of claims 1 to 9 for producing an optoelectronic or electronic component.