CLAIMS

1. A method for forming an Si-containing film that forms an Si-containing film on a substrate by a chemical vapor deposition process,

the chemical vapor deposition process comprising a step (a) that reacts a first feed gas having one or more Si-Si bonds in a chemical vapor deposition chamber in the presence of a Lewis base catalyst,

wherein the chemical vapor deposition process is a deposition process that forms an Si-containing film on a substrate that has a recess to fill at least part of the recess with the Si-containing film, and the recess is filled with a polymer obtained by condensation of the first feed gas in a state in which the polymer has fluidity, and when the Si-containing film is formed on a substrate that has a recess, the thickness of the Si-containing film formed on the bottom surface of the recess is larger than the thickness of the Si-containing film formed on the side surface of the recess;

wherein the first feed gas is pentachlorodisilane;

wherein the chemical vapor deposition process is effected at 0 to 400°C; and

wherein the ratio of the flow rate (SCCM) of the first feed gas to the flow rate (SCCM) of the Lewis base catalyst is 0.01 to 100, and preferably 0.05 to 10.

2. The method for forming an Si-containing film according to claim 1, wherein the step (a) produces a silylene in the chemical vapor deposition chamber as a reaction intermediate.

3. The method for forming an Si-containing film according to claim 1, wherein the total content ratio of a nitrogen atom, a carbon atom, a boron atom, a sulfur atom, and a phosphorus atom derived from the Lewis base in the Si-containing film is 0 to 5%.

~~4. The method for forming an Si-containing film according to claim 1, wherein the chemical vapor deposition process is effected at 0 to 400°C.~~

~~5. The method for forming an Si-containing film according to claim 1, wherein the chemical vapor deposition process is a deposition process that forms an Si-containing film on a substrate that has a recess to fill at least part of the recess with the Si-containing film, and the recess is filled with a polymer obtained by condensation of the first feed gas in a state in which the polymer has fluidity.~~

~~6~~4. The method for forming an Si-containing film according to claim 1, wherein the Lewis base is at least one compound selected from a group consisting of a tertiary amine and a heterocyclic amine.

~~7~~5. The method for forming an Si-containing film according to claim ~~6~~4, wherein the tertiary amine and the heterocyclic amine are alkylamines having 3 to 24 carbon atoms.

~~8~~6. The method for forming an Si-containing film according to claim 1, wherein the Lewis base is at least one compound selected from a group consisting of trimethylamine, triethylamine, pyridine, pyrimidine, pyrazine, and derivatives thereof.

~~9~~7. The method for forming an Si-containing film according to claim 1, wherein the chemical vapor deposition process is effected in a state in which the pressure inside the chemical vapor deposition chamber is 0.1 Torr to atmospheric pressure.

~~10~~8. The method for forming an Si-containing film according to claim 1, the chemical vapor deposition process further comprising:

a step (b) that adds a second feed gas, the second feed gas being at least one compound selected from a group consisting of a compound having at least one carbon-carbon unsaturated bond, an inert gas, a reducing gas, an oxidizing gas, and the Lewis base.

~~11~~9. The method for forming an Si-containing film according to claim ~~10~~8, wherein the second feed gas is a compound having 2 to 10 carbon atoms.

~~12~~10. The method for forming an Si-containing film according to claim ~~10~~8, wherein the second feed gas is a halogenated hydrocarbon.

~~13~~11. The method for forming an Si-containing film according to claim ~~10~~8, wherein the second feed gas is a compound represented by the following general formula (2),

$C_aH_bX_c$ (2)

wherein X is a halogen atom, a is a number from 2 to 9, b is a number from 0 to 19, and c is a number from 1 to 20; and

wherein a, b, and c satisfy the relationship of "$2a+2 \geq b+c$".

~~14~~12. The method for forming an Si-containing film according to claim 1, the chemical vapor deposition process further comprising:

a step (c) that performs a treatment in the presence of at least one compound selected from a group consisting of an inert gas, a reducing gas, an oxidizing gas, a nitriding gas, and the Lewis base, and/or a step (d) that applies an energy beam,

wherein the energy beam is one of a particle beam including an ion beam, an electron beam and a neutron beam, and ultraviolet light.

~~15~~13. The method for forming an Si-containing film according to claim ~~14~~12, wherein the step (c) is performed at a temperature of 0 to 800°C.

~~16. The method for forming an Si-containing film according to claim 5, wherein, when an Si-containing film is formed on a substrate that has a recess, the thickness of the Si-containing film formed on the bottom surface of the recess is larger than the thickness of the Si-containing film formed on the side surface of the recess.~~

~~17~~14. The method for forming an Si-containing film according to claim 1, wherein an oxygen-containing impurity content in the Lewis base is 0 to 1 wt%.

~~18~~15. The method for forming an Si-containing film according to claim 1, wherein the substrate has a recess having an aspect ratio (depth:width) of 1:1 to 20:1.