[0014]

(Configuration 9)

A phase shift mask including a phase shift film having a transfer pattern formed on a transparent substrate,

in which the phase shift film has a high nitrided layer and a low nitrided layer, and

in which the high nitrided layer and the low nitrided layer contain silicon, nitrogen, krypton, and xenon.

(Configuration 10)

The phase shift mask according to Configuration 9, in which the high nitrided layer has a nitrogen content of 50atom% or more.

[0015]

(Configuration 11)

The phase shift mask according to Configuration 9 or 10, in which the low nitrided layer has a nitrogen content of less than 50atom%.

(Configuration 12)

The phase shift mask according to any of Configurations 9 to 11, in which the high nitrided layer and the low nitrided layer have a total content of silicon, nitrogen, krypton, and xenon of 90atom% or more.

[0016]

(Configuration 13)

The phase shift mask according to any of Configurations 9 to 12, in which a total thickness of a thickness of the high nitride layer and a thickness of the low nitrided layer is 70% or more of a thickness of the phase shift film.

(Configuration 14)

The phase shift mask according to any of Configurations 9 to 13, in which the phase shift film has a structure where two or

[DOCUMENT] CLAIMS

[Claim 1]

A mask blank comprising a phase shift film on a transparent substrate,

wherein the phase shift film has a high nitrided layer and a low nitrided layer,

wherein the high nitrided layer and the low nitrided layer contain silicon, nitrogen, krypton, and xenon,

wherein the high nitrided layer has a nitrogen content of 50atom% or more,

wherein the low nitrided layer has a nitrogen content of less than 50atom%, and

wherein the high nitrided layer and the low nitrided layer contain krypton and xenon at a level that is detected by high-resolution Rutherford backscattering spectroscopy.

[Claim 2]

The mask blank according to claim 1, wherein the high nitrided layer and the low nitrided layer have a total content of silicon, nitrogen, krypton, and xenon of 90atom% or more.

[Claim 3]

The mask blank according to claim 1 or 2, wherein a total thickness of a thickness of the high nitrided layer and a thickness of the low nitrided layer is 70% or more of a thickness of the phase shift film.

[Claim 4]

The mask blank according to any of claims 1 to 3, wherein the phase shift film has a structure where two or more of the high nitrided layers and two or more of the low nitrided layers are stacked alternately.

[Claim 5]

The mask blank according to any of claims 1 to 4, wherein

the phase shift film has a function to transmit an exposure light of an ArF excimer laser at a transmittance of 2% or more, and a function to generate a phase difference of 150 degrees or more and 210 degrees or less between the exposure light transmitted through the phase shift film and the exposure light transmitted through the air for a same distance as a thickness of the phase shift film.

[Claim 6]

The mask blank according to any of claims 1 to 5 comprising a light shielding film on the phase shift film.

[Claim 7]

A phase shift mask comprising a phase shift film having a transfer pattern formed on a transparent substrate,

wherein the phase shift film has a high nitrided layer and a low nitrided layer,

wherein the high nitrided layer and the low nitrided layer contain silicon, nitrogen, krypton, and xenon,

wherein the high nitrided layer has a nitrogen content of 50atom% or more,

wherein the low nitrided layer has a nitrogen content of less than 50atom%, and

wherein the high nitrided layer and the low nitrided layer contain krypton and xenon at a level that is detected by high-resolution Rutherford backscattering spectroscopy.

[Claim 8]

The phase shift mask according to claim 7, wherein the high nitrided layer and the low nitrided layer have a total content of silicon, nitrogen, krypton, and xenon of 90atom% or more.

[Claim 9]

The phase shift mask according to claim 7 or 8, wherein a total thickness of a thickness of the high nitrided layer and a

thickness of the low nitrided layer is 70% or more of a thickness of the phase shift film.

[Claim 10]

The phase shift mask according to any of claims 7 to 9, wherein the phase shift film has a structure where two or more of the high nitrided layers and two or more of the low nitrided layers are stacked alternately.

[Claim 11]

The phase shift mask according to any of claims 7 to 10, wherein the phase shift film has a function to transmit an exposure light of an ArF excimer laser at a transmittance of 2% or more, and a function to generate a phase difference of 150 degrees or more and 210 degrees or less between the exposure light transmitted through the phase shift film and the exposure light transmitted through the air for a same distance as a thickness of the phase shift film.

[Claim 12]

The phase shift mask according to any of claims 7 to 11 comprising a light shielding film having a light shielding pattern formed on the phase shift film.

[Claim 13]

A method of manufacturing a semiconductor device comprising the step of using the phase shift mask according to any of claims 7 to 12 and exposure-transferring a transfer pattern in a resist film on a semiconductor substrate.