CLAIMS

1. A reflective photomask blank comprising:

a substrate;

a reflection part provided on the substrate and configured to reflect incident light; and

a low reflection part provided on the reflection part and configured to absorb incident light,

wherein the low reflection part has a multi-layer structure including at least two or more layers, and

an outermost layer of the low reflection part has a refractive index n equal to or more than 0.90 and an extinction coefficient k equal to or less than 0.02 with respect to extreme ultraviolet (EUV) light (where a wavelength is 13.5 nm),

wherein the outermost layer is constituted of a compound material in which an atomic number ratio of silicon (Si) to oxygen (O) is within a range of 1:1.5 to 1:2, and a total content of the silicon and the oxygen is 50% by atom or more of a whole compound material.

2. A reflective photomask blank comprising:

a substrate;

a reflection part provided on the substrate and configured to reflect incident light; and

a low reflection part provided on the reflection part and configured to absorb incident light,

wherein the low reflection part has a multi-layer structure including at least two or more layers, and

an outermost layer of the low reflection part has a refractive index n equal to or more than 0.90 and an extinction coefficient k equal to or less than 0.02 with respect to extreme ultraviolet (EUV) light (where a wavelength is 13.5 nm),

wherein the low reflection part has an absorption layer provided between the outermost layer and the reflection part and configured to absorb incident light, and

the absorption layer is constituted of a compound material in which an atomic number ratio of indium (In) to oxygen (O) is within a range of 1:1 to 1:1.5, and a total content of the indium and the oxygen is 80% by atom or more of a whole compound material.

3. The reflective photomask blank according to claim 2, wherein the outermost layer is constituted of a compound material in which an atomic number ratio of silicon (Si) to oxygen (O) is within a range of 1:1.5 to 1:2, and a total content of the silicon and the oxygen is 50% by atom or more of a whole compound material.

4. The reflective photomask blank according to any one of claims 1 to 3, wherein a compound material constituting the outermost layer further contains one or

more elements selected from boron (B), nitrogen (N), germanium (Ge), and hafnium (Hf).

5. The reflective photomask blank according to any one of claims 1 to 4, wherein the outermost layer has a film thickness equal to or more than 1 nm and equal to or less than 20 nm.

6. The reflective photomask blank according to any one of claims 1 and 3 to 5,

wherein the low reflection part has an absorption layer provided between the outermost layer and the reflection part and configured to absorb incident light, and

the absorption layer is constituted of a compound material having a refractive index n equal to or less than 0.95 and an extinction coefficient k equal to or more than 0.06 with respect to the EUV light.

7. The reflective photomask blank according to any one of claims 1 and 3 to 5,

wherein the low reflection part has an absorption layer provided between the outermost layer and the reflection part and configured to absorb incident light, and

the absorption layer is constituted of a compound material in which an atomic number ratio of tin (Sn) to oxygen (O) is within a range of 1:1 to 1:2, and a total

content of the tin and the oxygen is 75% by atom or more of a whole compound material.

8. The reflective photomask blank according to any one of claims 1 and 3 to 5,

wherein the low reflection part has an absorption layer provided between the outermost layer and the reflection part and configured to absorb incident light, and

the absorption layer is constituted of a compound material in which an atomic number ratio of indium (In) to oxygen (O) is within a range of 1:1 to 1:1.5, and a total content of the indium and the oxygen is 80% by atom or more of a whole compound material.

9. The reflective photomask blank according to any one of claims 6 to 8, wherein a compound material constituting the absorption layer further contains one or more elements selected from boron (B), nitrogen (N), silicon (Si), germanium (Ge), and hafnium (Hf).

10. The reflective photomask blank according to any one of claims 6 to 9, wherein the absorption layer has a film thickness equal to or more than 18 nm and equal to or less than 48 nm.

11. The reflective photomask blank according to any one of claims 1 to 10, wherein the low reflection

part has an optical density (an OD value) equal to or more than 1.5 with respect to the reflection part.

12. A reflective photomask comprising:

a substrate;

a reflection part provided on the substrate and configured to reflect incident light; and

a low reflection part provided on the reflection part and configured to absorb incident light,

wherein the low reflection part has a multi-layer structure including at least two or more layers, and

an outermost layer of the low reflection part has a refractive index n equal to or more than 0.90 and an extinction coefficient k equal to or less than 0.02 with respect to extreme ultraviolet (EUV) light (where a wavelength is 13.5 nm),

wherein the outermost layer is constituted of a compound material in which an atomic number ratio of silicon (Si) to oxygen (O) is within a range of 1:1.5 to 1:2, and a total content of the silicon and the oxygen is 50% by atom or more of a whole compound material.

13. A reflective photomask comprising:

a substrate;

a reflection part provided on the substrate and configured to reflect incident light; and

a low reflection part provided on the reflection part and configured to absorb incident light,

wherein the low reflection part has a multi-layer structure including at least two or more layers, and

an outermost layer of the low reflection part has a refractive index n equal to or more than 0.90 and an extinction coefficient k equal to or less than 0.02 with respect to extreme ultraviolet (EUV) light (where a wavelength is 13.5 nm),

wherein the low reflection part has an absorption layer provided between the outermost layer and the reflection part and configured to absorb incident light, and

the absorption layer is constituted of a compound material in which an atomic number ratio of indium (In) to oxygen (O) is within a range of 1:1 to 1:1.5, and a total content of the indium and the oxygen is 80% by atom or more of a whole compound material