CLAIMS

WHAT IS CLAIMED IS:

1. A blank mask comprising:

a light-transmitting substrate; and

a light-shielding film on the light-transmitting substrate,

wherein the light-shielding film comprises a transition metal and oxygen,

a scum formation time required to generate scum is 120 minutes or more when light with a wavelength of 172 nm and an intensity of 10 kJ/cm^2 is applied to the light-shielding film, and

wherein a surface of the light-shielding film comprises oxygen content in an amount of 35 or more and 55 or less atomic percent.

2. The blank mask of claim 1, wherein a surface of the light-shielding film comprises transition metal content in an amount of 30 or more and 50 or less atomic percent.

3. The blank mask of claim 1, wherein the light-shielding film comprises a first light-shielding layer, and a second light-shielding layer on the first light-shielding layer,

wherein an etching rate of the second light-shielding layer measured by etching with argon gas is 0.4 Å/s or more and 0.5 Å/s or less.

4. The blank mask of claim 3, wherein an etching rate of the first light-

shielding layer measured by etching with argon gas is 0.56 Å/s or more.

5. The blank mask of claim 1, wherein an etching rate of the light-shielding film measured by etching with chlorine-based gas is 1.3 Å/s or more.

6. The blank mask of claim 1, wherein the light-shielding film comprises a first light-shielding layer, and a second light-shielding layer on the first light-shielding layer,

wherein the second light-shielding layer comprises transition metal content in an amount of 50 or more and 80 or less atomic percent and oxygen content in an amount of 10 or more atomic percent.

7. The blank mask of claim 1, wherein the transition metal comprises one or more selected from the group consisting of: scandium (Sc), titanium (Ti), vanadium (V), chromium (Cr), manganese (Mn), iron (Fe), cobalt (Co), nickel (Ni), copper (Cu), zinc (Zn), yttrium (Y), zirconium (Zr), niobium (Nb), molybdenum (Mo), technetium (Tc), ruthenium (Ru), rhodium (Rh), palladium (Pd), silver (Ag), cadmium (Cd), lanthanum (La), hafnium (Hf), tantalum (Ta), tungsten (W), rhenium (Re), osmium (Os), iridium (Ir), platinum (Pt), gold (Au), mercury (Hg), actinium (Ac), rutherfordium (Rf), dubnium (Db), seaborgium (Sg), bohrium (Bh), hassium (Hs), meitnerium (Mt), darmstadtium (Ds), roentgenium (Rg), ununbiium (Uub), and a combination thereof.

8. The blank mask of claim 1, wherein the light-shielding film comprises a first light-shielding layer, and a second light-shielding layer on the first light-

shielding layer,

wherein a ratio of a thickness of the second light-shielding layer to a thickness of the light-shielding film is in a range of 0.05 or more and 0.15 or less.

9. A photomask obtained from the blank mask of claim 1, the photomask comprising:

the light-transmitting substrate; and

the light-shielding pattern film on the light-transmitting substrate,

wherein the light-shielding pattern film comprises a transition metal and oxygen,

the scum formation time required to generate scum is 120 minutes or more when light with a wavelength of 172 nm and an intensity of 10 kJ/cm^2 is applied to the light-shielding pattern film, and

wherein a surface of the light-shielding pattern film comprises oxygen content in an amount of 35 or more and 55 or less atomic percent.

10. A method of manufacturing a semiconductor device, the method comprising:

disposing a light source, a photomask, and a semiconductor wafer coated with a resist film;

selectively exposing the semiconductor wafer to light from the light source through the photomask; and

developing a pattern on the semiconductor wafer,

wherein the photomask comprises a light-transmitting substrate and a light-shielding pattern film disposed on the light-transmitting substrate,

the light-shielding pattern film comprises a transition metal and oxygen,

a scum formation time required to generate scum is 120 minutes or more when light with a wavelength of 172 nm and an intensity of 10 kJ/cm^2 is applied to the light-shielding pattern film, and

wherein a surface of the light-shielding pattern film comprises oxygen content in an amount of 35 or more and 55 or less atomic percent.