CLAIMS

1. A reflective mask (100) comprising:

a substrate (11);

a reflective film (12) configured to reflect an EUV light having a multi-layer film structure formed on the substrate;

a protective film (13) formed on the reflective film, and configured to protect the reflective film;

an absorption film (14a) configured to absorb the EUV light formed on the protective film; and

an oxide coating (15) formed on the absorption film; wherein

the absorption film (14a) contains Sn and a metal element other than Sn and has a ratio of an atomic number of the Sn to a total atomic number of the metal element other than Sn (Sn/Metal element other than Sn) within a range of 1 or more and less than 20, and

the oxide coating (15) is resistant to a hydrogen radical and formed on a surface and side surfaces of the absorption film (14a),

wherein the oxide coating (15) is an oxide coating of at least one metal selected from Cr, Nb, Ti, Al, V and Hf, or an oxide coating of Sn and at least one metal selected from Cr, Nb, Ti, Al, V and Hf.

2. The reflective mask (100) according to claim 1, wherein

the absorption film (14a) contains Sn in a proportion of 50 at% or more.

3. The reflective mask (100) according to claim 1 or 2, wherein the oxide coating (15) does not contain Sn or the oxide coating (15) contains Sn, and a content of the Sn is smaller than a content of a compound containing at least one of oxides of Cr, Nb, Ti, Al, V, and Hf.

4. The reflective mask (100) according to any one of claims 1 to 3, wherein the oxide coating (15) has a film thickness of 1 nm or more.

5. The reflective mask (100) according to any one of claims 1 to 4, wherein the absorption film (14a) does not contain B, C, P, Si, and Ge, which are metalloid elements, or contains at least one of the metalloid elements, and has a ratio of a total atomic number of the metalloid element to a total atomic number of the metal element other than Sn (Metalloid element/Metal element other than Sn) within a range of 0 or more and 1 or less.

6. The reflective mask (100) according to any one of claims 1 to 5, wherein the absorption film (14a) is able to be etched with a fluorine-based gas or a chlorine-based gas.

7. The reflective mask (100) according to any one of claims 1 to 6, wherein a total film thickness of the absorption film (14a) and the oxide coating (15) is 45 nm or less, and an OD value (Optical Density) is 1.0 or more.

8. A method for producing a reflective mask (100), the reflective mask including:

a substrate (11);

a reflective film (12) configured to reflect an EUV light having a multi-layer film structure formed on the substrate;

a protective film (13) configured to protect the reflective film formed on the reflective film;

an absorption film (14a) configured to absorb the EUV light formed on the protective film; and

an oxide coating (15) formed on the absorption film; wherein

the absorption film (14a) contains Sn and a metal element other than Sn and has a ratio of an atomic number of the Sn to a total atomic number of the metal element other than Sn (Sn/Metal element other than Sn) within a range of 1 or more and less than 20, and

the oxide coating (15) is resistant to a hydrogen radical and formed on a surface and side surfaces of the absorption film (14a),

wherein the oxide coating (15) is an oxide coating of at least one metal selected from Cr, Nb, Ti, Al, V and Hf, or an oxide coating of Sn and at least one metal selected from Cr, Nb, Ti, Al, V and Hf, and

wherein the oxide coating (15) is formed by oxidizing the absorption film (14a).

9. The method for producing a reflective mask (100) according to claim 8, wherein

the absorption film (14) contains Sn in a proportion of 50 at% or more.