What is claimed is:

1. A multilayered-reflective-film-provided substrate comprising:

a substrate;

a multilayered reflective film provided on the substrate; and

a protective film provided on the multilayered reflective film, wherein

the protective film includes ruthenium (Ru) and additive material,

the additive material includes at least one of the following elements: aluminum (Al), rhodium (Rh), and hafnium (Hf),

a content of Al is 5% or more by atom and 40% or less by atom,

a content of Rh is 15% or more by atom and less than 50% by atom, and

a content of Hf is 5% or more by atom and 30% or less by atom.

2. The multilayered-reflective-film-provided substrate according to claim 1, wherein

the protective film further includes nitrogen (N), and a content of N is 1% or more by atom and 20% or less by atom.

3. The multilayered-reflective-film-provided substrate according to claim 1 or 2, wherein

the extinction coefficient of the protective film is

0.030 or less.

4. The multilayered-reflective-film-provided substrate according to any one of claims 1 to 3, wherein

the protective film includes a first layer and a second layer in order from a side closer to the substrate,

the first layer includes ruthenium (Ru) and at least one of the following elements: magnesium (Mg), aluminum (Al), titanium (Ti), vanadium (V), chromium (Cr), germanium (Ge), zirconium (Zr), niobium (Nb), molybdenum (Mo), rhodium (Rh), hafnium (Hf), and tungsten (W),

the second layer includes ruthenium (Ru) and the additive material, and

the additive material includes at least one of the following elements: aluminum (Al), rhodium (Rh), and hafnium (Hf).

5. The multilayered-reflective-film-provided substrate according to claim 4, wherein

the first layer or the second layer further includes nitrogen (N).

6. The multilayered-reflective-film-provided substrate according to claim 5, wherein a content of N in the first layer or the second layer is 1% or more by atom and 20% or less by atom.

7. The multilayered-reflective-film-provided substrate according to any one of claims 4 to 6, wherein

a content of Ru in the second layer is less than a content of Ru in the

first layer.

8. The multilayered-reflective-film-provided substrate according to any one of claims 4 to 7, wherein

the extinction coefficient of the second layer is less than the extinction coefficient of the first layer.

9. A reflective mask blank comprising:

an absorber film on the protective film of the multilayered-reflective-film-provided substrate according to any one of claims 1 to 8.

10. The reflective mask blank according to claim 9, further comprising:

an etching mask film including chromium (Cr), on the absorber film.

11. A reflective mask, comprising:

an absorber pattern including the absorber film in the reflective mask blank according to claim 9 or 10, patterned.

12. A method of manufacturing a reflective mask, the method comprising:

patterning the etching mask film of the reflective mask blank according to claim 10 to form an etching mask pattern;

patterning the absorber film with the etching mask pattern as a mask, to form an absorber pattern; and

removing the etching mask pattern by a gaseous mixture of chlorine-based gas and oxygen gas.

13. A method of manufacturing a semiconductor device, the

method comprising:

setting the reflective mask according to claim 11 to an exposure device including an exposure light source that emits EUV light; and

transferring a transfer pattern to a resist film formed on a substrate to which transfer is to be performed.