CLAIMS

1. A substrate with a multilayer reflective film comprising: a substrate; and a multilayer reflective film for reflecting exposure light, the multilayer reflective film being formed of a multilayer film in which a low refractive index layer and a high refractive index layer are alternately layered on the substrate, wherein

the low refractive index layer comprises molybdenum (Mo),

the high refractive index layer comprises silicon (Si),

the multilayer reflective film comprises at least one additive element selected from hydrogen (H), deuterium (D), and helium (He), and

the additive element in the multilayer reflective film has an atomic number density of 0.006 atom/nm^3 or more and 0.50 atom/nm^3 or less.

2. The substrate with a multilayer reflective film according to claim 1, wherein the atomic number density of the additive element in the multilayer reflective film is 0.10 atom/nm^3 or less.

3. The substrate with a multilayer reflective film according to claim 1 or 2, wherein the additive element is deuterium (D).

4. The substrate with a multilayer reflective film according to any one of claims 1 to 3, further comprising a protective film on the multilayer reflective film.

5. A reflective mask blank comprising an absorber film on the multilayer reflective film of the substrate with a multilayer reflective film according to any one of claims 1 to 3 or on the protective film of the substrate with a multilayer reflective film according to claim 4.

6. A reflective mask comprising an absorber pattern obtained by patterning the absorber film of the reflective mask blank according to claim 5.

7. A method for manufacturing a semiconductor device, comprising performing a lithography process with an exposure apparatus using the reflective mask according to claim 6 to form a transfer pattern on a transferred object.