CLAIMS

1. A reflective mask comprising:

a substrate;

a reflective portion formed on the substrate and reflecting an incident light;

an absorption portion formed on at least a part of the reflective portion and absorbing the incident light; and

a coating film formed on the reflective portion and the absorption portion and transmitting the incident light, wherein

the coating film has an extinction coefficient k of 0.04 or less to an extreme ultraviolet, that is, EUV light having a wavelength of 13.5 nm, is resistant to cleaning with a cleaning chemical solution, and is formed with a uniform film thickness on an outermost surface and side surfaces of the absorption portion,

wherein the coating film is formed of a compound containing at least chromium, and

wherein the uniform film thickness means that, with respect to an average film thickness of the coating film formed on the outermost surface and the side surfaces of the absorption portion, a thickness of a thinnest portion is within −2 nm and a thickness of a thickest portion is within +2 nm.

2. The reflective mask according to claim 1, wherein the compound containing at least chromium contains chromium and at least one element selected from oxygen, nitrogen, and fluorine.

3. The reflective mask according to claim 1 or claim 2, wherein the compound containing at least chromium contains chromium and oxygen.

4. The reflective mask according to any one of claims 1 to 3, wherein the coating film is formed by an atomic layer deposition method.

5. The reflective mask according to claim 4, wherein, in formation of the coating film, the coating film is formed by the atomic layer deposition method using a metal hydride, a metal halide, or an organometallic compound as a material gas.

6. The reflective mask according to any one of claims 1 to 5, wherein the absorption portion is formed of a compound containing at least one of tantalum, tin, indium, nickel, osmium, hafnium, tungsten, platinum, tellurium, cobalt, and palladium.

7. The reflective mask according to any one of claims 1 to 6, wherein a thickness of the absorption portion is 20 nm or more and 40 nm or less.

8. The reflective mask according to any one of claims 1 to 7, wherein the coating film continuously covers the reflective portion, the outermost surface of the absorption portion, and the side surfaces of the absorption portion.

9. The reflective mask according to any one of claims 1 to 8, wherein the coating film includes a portion formed on the reflective portion, a portion formed on the outermost surface of the absorption portion, and portions formed on the side surfaces of the absorption portion, and these portions are continuous with each other as an integral film.

10. A production method for the reflective mask according to any one of claims 1 to 9, the method comprising:

forming the coating film by an atomic layer deposition method.

11. The production method for the reflective mask according to claim 10, wherein, in forming the coating film, a metal hydride, a metal halide, or an organometallic compound is used as a material gas.