present invention, a method of manufacturing a substrate with multilayer reflective film and reflective mask blank used to manufacture a reflective mask having multilayer reflective film having high reflectance with respect to exposure light and little film stress, can be provided. Moreover, according to the present invention, a method of manufacturing a semiconductor device using the aforementioned reflective mask can be provided.

BRIEF DESCRIPTION OF THE DRAWINGS

[0023] FIG. 1 is a cross-sectional schematic diagram of one example of the substrate with multilayer reflective film of the present invention.

FIG. 2 is a cross-sectional schematic diagram of another example of the substrate with multilayer reflective film of the present invention.

FIG. 3 is a cross-sectional schematic diagram of one example of the reflective mask blank of the present invention.

FIG.4(a) to FIG.4(e) are cross sectional schematic diagrams showing the method of manufacturing the reflective mask of the present invention.

FIG. 5 is a schematic diagram of the internal structure of an ion beam sputtering apparatus.

FIG. 6 is a graph indicating the degree of flatness and EUV light reflectance versus annealing temperature of a substrate with multilayer reflective film manufactured using Kr or Ar.

FIG. 7 is a graph indicating the results of analyzing the multilayer reflective film of Example 1 by Rutherford backscattering analysis.

MODE FOR CARRYING OUT THE INVENTION

[0024] The following provides a detailed explanation of embodiments of the present invention with reference to the drawings. Furthermore, the following embodiments are for providing a detailed explanation of the present invention, and do not limit the present invention to the scope thereof.

[0025] As shown in FIG. 1, a substrate with multilayer reflective film 110 of the present invention is provided with a multilayer reflective film 5 on a substrate 1. The multilayer reflective film 5 is a film for reflecting exposure light and is comprised of a multilayer film obtained by alternately laminating low refractive index layers and high refractive index layers. The multilayer reflective film in the substrate with multilayer reflective film 110 of the present invention is characterized by containing krypton (Kr).

[0026] When manufacturing the substrate with multilayer reflective film 110 of the present invention, the multilayer reflective film 5 is deposited on the substrate 1 by ion