CLAIMS

1. A substrate with a thin film comprising: a substrate; and at least one thin film formed on a main surface of the substrate, wherein

the thin film comprises a matrix material constituting the thin film and a small-amount material other than the matrix material,

the small-amount material comprises at least one element selected from yttrium (Y), zirconium (Zr), niobium (Nb), aluminum (Al), and titanium (Ti), and

when secondary ion intensity emitted from the thin film is measured by time-of-flight secondary ion mass spectrometry (TOF-SIMS), a ratio (I_2/I_1) of secondary ion intensity (I_2) of at least one of the small-amount material in the thin film to secondary ion intensity (I_1) of the matrix material is more than 0 and 0.300 or less.

2. The substrate with a thin film according to claim 1, wherein the thin film is at least one selected from a conductive back film, a multilayer reflective film, a protective film, an absorber film, and an etching mask film.

3. The substrate with a thin film according to claim 2, wherein the thin film is a multilayer reflective film, and the matrix material is molybdenum (Mo).

4. The substrate with a thin film according to claim 2, wherein the thin film is a protective film, and the matrix material is ruthenium (Ru).

5. A reflective mask blank comprising an absorber film on the substrate with a thin film according to any one of claims 1 to 4, wherein the thin film is at least one selected from a multilayer reflective film and a protective film.

6. A reflective mask having an absorber pattern in which the absorber film in the reflective mask blank according to claim 5 is patterned.

7. A method for manufacturing a semiconductor device, the method comprising setting the reflective mask according to claim 6 in an exposure apparatus having an exposure light source that emits EUV light and transferring a transfer pattern to a resist film formed on a transfer target substrate.