WHAT IS CLAIMED IS:

1. A substrate processing method, comprising:

(a) forming a nitride film containing a predetermined element on a substrate by performing a cycle a predetermined number of times, the cycle including sequentially performing:

(a-1) supplying a first precursor gas containing the predetermined element to the substrate;

(a-2) supplying a second precursor gas containing the predetermined element and having a thermal decomposition temperature lower than a thermal decomposition temperature of the first precursor gas to the substrate; and

(a-3) supplying a nitriding gas to the substrate;

(b) oxidizing the nitride film formed in (a) and modifying the nitride film into an oxide film containing the predetermined element by supplying an oxidizing gas to the substrate; and

(c) supplying a hydrogen nitride-based gas to the substrate before performing (a).

2. The substrate processing method of Claim 1, wherein a cycle that includes performing (a) and (b) is performed a predetermined number of times, and (c) is performed whenever the cycle is performed.

3. The substrate processing method of Claim 1 or Claim 2, wherein the nitriding gas is the hydrogen nitride-based gas.

4. The substrate processing method of any one of Claims 1 to 3, wherein the hydrogen nitride-based gas is at least one gas selected from the group consisting of a NH_3 gas, a N_2H_2 gas, a N_2H_4 gas, and a N_3H_8 gas.

5. The substrate processing method of any one of Claims 1 to 4, wherein the oxidizing gas

is at least one gas selected from the group consisting of an O_2 gas, an O_3 gas, an O_2 gas and a H_2 gas, a H_2O gas, a gas containing O radicals, a gas containing OH radicals, and a gas containing plasma-excited O_2.

6. The substrate processing method of Claim 1, wherein a thickness of the nitride film formed in (a) is made to a thickness at which an effect of oxidation in (b) is applied over an entirety of the nitride film in a thickness direction.

7. The substrate processing method of Claim 1, wherein (a) and (b) are performed in a same process chamber.

8. The substrate processing method of Claim 1, wherein as the first precursor gas, a gas whose dissociation energy required for decomposing one molecule into a plurality of molecules is larger than a dissociation energy of the second precursor gas is used.

9. The substrate processing method of Claim 1, wherein the first precursor gas does not contain a bond between atoms of the predetermined element in one molecule, and

wherein the second precursor gas contains a bond between atoms of the predetermined element in one molecule.

10. The substrate processing method of Claim 9, wherein the first precursor gas contains only one atom of the predetermined element in one molecule, and

wherein the second precursor gas contains two or more atoms of the predetermined element in one molecule.

11. The substrate processing method of Claim 1, wherein the first precursor gas is at least one gas selected from the group consisting of a $SiCl_4$ gas, a SiH_2Cl_2 gas, a SiH_3Cl gas, and a $SiHCl_3$ gas, and

wherein the second precursor gas is at least one gas selected from the group consisting of a Si_2Cl_6 gas, a Si_2H_5Cl gas, a $Si_2H_4Cl_2$ gas, a $Si_2H_3Cl_3$ gas, a $Si_2H_2Cl_4$ gas, a Si_3H_5Cl gas, and a $Si_3H_4Cl_2$ gas.

12. A method of manufacturing a semiconductor device, comprising:

(a) forming a nitride film containing a predetermined element on a substrate by performing a cycle a predetermined number of times, the cycle including sequentially performing:

(a-1) supplying a first precursor gas containing the predetermined element to the substrate;

(a-2) supplying a second precursor gas containing the predetermined element and having a thermal decomposition temperature lower than a thermal decomposition temperature of the first precursor gas to the substrate; and

(a-3) supplying a nitriding gas to the substrate;

(b) oxidizing the nitride film formed in (a) and modifying the nitride film into an oxide film containing the predetermined element by supplying an oxidizing gas to the substrate; and

(c) supplying a hydrogen nitride-based gas to the substrate before performing (a).

13. A program that causes, by a computer, a substrate processing apparatus to perform a process in a process chamber of the substrate processing apparatus, the process comprising:

(a) forming a nitride film containing a predetermined element on a substrate by performing a cycle a predetermined number of times, the cycle including sequentially performing:

(a-1) supplying a first precursor gas containing the predetermined element to the substrate;

(a-2) supplying a second precursor gas containing the predetermined element and having a thermal decomposition temperature lower than a thermal decomposition temperature of the first precursor gas to the substrate; and

(a-3) supplying a nitriding gas to the substrate;

(b) oxidizing the nitride film formed in (a) and modifying the nitride film into an oxide film containing the predetermined element by supplying an oxidizing gas to the substrate; and

(c) supplying a hydrogen nitride-based gas to the substrate before performing (a).

14. A substrate processing apparatus, comprising:

a first precursor gas supply system configured to supply a first precursor gas containing a predetermined element to a substrate;

a second precursor gas supply system configured to supply a second precursor gas containing the predetermined element and having a thermal decomposition temperature lower than a thermal decomposition temperature of the first precursor gas to the substrate;

a hydrogen nitride-based gas supply system configured to supply a hydrogen nitride-based gas to the substrate;

an oxidizing gas supply system configured to supply an oxidizing gas to the substrate; and

a controller configured to be capable of controlling the first precursor gas supply system, the second precursor gas supply system, the hydrogen nitride-based gas supply system, and the oxidizing gas supply system so as to perform a process comprising:

(a) forming a nitride film containing a predetermined element by performing a cycle a predetermined number of times, the cycle including sequentially performing:

(a-1) supplying the first precursor gas to the substrate;

(a-2) supplying the second precursor gas to the substrate; and

(a-3) supplying the hydrogen nitride-based gas to the substrate;

(b) oxidizing the nitride film formed in (a) and modifying the nitride film into an oxide film containing the predetermined element by supplying the oxidizing gas to the substrate; and

(c) supplying the hydrogen nitride-based gas to the substrate before performing (a).