WHAT IS CLAIMED IS:

~~1. A treatment liquid for a semiconductor with ruthenium, comprising at least a bromine-containing compound, an oxidizing agent, a basic compound, and water, wherein the treatment liquid has the bromine-containing compound added in an amount of 0.008 mass% or more and less than 2.0 mass% as a bromine element content with respect to the total mass of the treatment liquid, has the oxidizing agent added in an amount of 0.1 mass ppm or more and 10 mass% or less with respect to the total mass, and has a pH of 8 or more and 14 or less.~~

~~2~~1. A treatment liquid for a semiconductor with ruthenium, comprising at least a bromine-containing compound, an oxidizing agent, a basic compound, and water, wherein the treatment liquid has the bromine-containing compound added in an amount of 0.008 mass% or more and less than 2.0 mass% as a bromine element content with respect to the total mass of the treatment liquid, has the oxidizing agent added in an amount of 0.1 mass ppm or more and 10 mass% or less with respect to the total mass, and has a pH of 8 or more and 14 or less, and

the bromine-containing compound contains a hypobromite ion and one or more kinds of bromous acid, bromous acid ion, bromic acid, bromic acid ion, and bromide ion, and

a concentration of hypobromite ion as a bromine element content in the treatment liquid is 0.001 mol/L or more and 0.20 mol/L or less.

2~~3~~. The treatment liquid for a semiconductor according to claim ~~2~~1, wherein the proportion of the hypobromite ion in 1 mol of bromine element contained in the treatment liquid for a semiconductor is more than 0.5 mol.

~~4. The treatment liquid for a semiconductor with ruthenium according to any one of claims 1 to 3, having the bromine-containing compound added in an amount of 0.08 mass% or more and less than 2.0 mass% as a bromine element content.~~

~~5~~3. The treatment liquid for a semiconductor with ruthenium according to ~~any one of~~ claim~~s~~ 1 ~~to~~ or ~~4~~2, having the bromine-containing compound added in an amount of 0.01 mass% or more and less than 2 mass% as a bromine element content, and having the oxidizing agent added in an amount of 0.1 mass% or more and 10 mass% or less.

~~6~~4. The treatment liquid for a semiconductor according to any one of claims 1 to ~~5~~3, wherein the ruthenium is a ruthenium metal or a ruthenium alloy.

~~7~~5. The treatment liquid for a semiconductor according to any one of claims 1 to ~~6~~4, wherein the oxidizing agent is a hypochlorous acid compound or ozone.

~~8~~6. The treatment liquid for a semiconductor according to any one of claims 1 to ~~7~~5, wherein the bromine-containing compound is a bromine salt or hydrogen bromide.

~~9~~7. The treatment liquid for a semiconductor according to claim ~~8~~6, wherein the bromine salt is a tetraalkylammonium bromide.

~~10~~8. The treatment liquid for a semiconductor according to any one of claims 1 to ~~9~~7, wherein the basic compound is a tetramethylammonium hydroxide.

~~11~~9. The treatment liquid for a semiconductor according to any one of claims 1 to ~~10~~8, wherein the pH is 12 or more and 14 or less.

~~12~~10. A method of producing the treatment liquid for a semiconductor according to any one of claims 1 to ~~11~~9, comprising a step of mixing the bromine-containing compound and a solution containing both the oxidizing agent and the basic compound.

~~13~~11. A method of producing the treatment liquid for a semiconductor according to any one of claims 1 to ~~11~~9, comprising a step of mixing the bromine-containing compound into an aqueous solution of both the oxidizing agent and the basic compound.

~~14~~12. A method of treating a substrate, comprising the steps of: producing a

treatment liquid for a semiconductor by the production method according to claim 10~~2~~ or ~~13~~11; and then using the treatment liquid for a semiconductor to etch a ruthenium metal film and/or a ruthenium alloy film deposited on the substrate.