SUMMARY ~~OF THE INVENTION~~

[0007a] In a first aspect of the present disclosure, there is provided a method for producing hydrogen gas, comprising the steps of:

preparing a silicon material A for hydrogen gas production, the silicon material A for hydrogen gas production comprising: silicon particles; oil content derived from a coolant, the oil content being 0.1 weight % to 10 weight % of the silicon particles; and water;

preparing an alkaline aqueous solution;

supplying the silicon material A for hydrogen gas production and the alkaline aqueous solution in a reaction chamber;

injecting the silicon material A for hydrogen gas production into the reaction chamber while feed-back controlling an injection rate thereof based on a temperature of a mixed liquid of the silicon material A for hydrogen gas production and the alkaline aqueous solution in the reaction chamber and a time change rate of the temperature;

injecting the alkaline aqueous solution into the reaction chamber while feed-back controlling an injection rate thereof by measuring alkali concentration of the mixed liquid and calculating a time change rate of the alkali concentration;

maintaining the mixed liquid in the reaction chamber at a predetermine temperature;

treating gas P including hydrogen gas, steam, alkaline aqueous solution mist, metasilicate hydrate mist, and silicon particles by a scrubber, which has been taken out of the reaction chamber, to remove the alkaline aqueous solution mist, the metasilicate hydrate mist, and the silicon particles from the gas P; and

treating gas Q including the hydrogen gas and the steam which is obtained by treating the gas P by the scrubber to remove the steam from the gas Q by treating with a condenser.

[0007b] In a second aspect of the present disclosure, there is provided a method for producing hydrogen gas, comprising the steps of:

preparing a silicon material B for hydrogen gas production comprising: silicon particles; any one of formic acid, lactic acid, acetic acid, propane acid, butanoic acid, pentanoic acid, hexanoic acid, heptanoic acid, octanoic acid, nonanoic acid, decanoic acid, undecanoic acid, dodecanoic acid, tetradecanoic acid, hexadecanoic acid, heptadecanoic acid, acrylic acid, oleic acid, malic acid, citric acid, oxalic acid, maleic acid, fumaric acid, vinyl pyrrolidone, polyvinyl pyrrolidone, sodium polyacrylate, polyethylene oxide, polyethylene imide, polyvinyl alcohol, polyacrylamide and polyethylene glycol in a range of 0.1 weight % to 10 weight % or a mixture of at least two selected therefrom, and water;

preparing an alkaline aqueous solution;

supplying the reaction chamber with the silicon material B and the alkaline aqueous solution;

injecting the silicon material B for hydrogen gas production into the reaction chamber while feed-back controlling an injection rate thereof based on a temperature of a mixed liquid of the silicon material B for hydrogen gas production and the alkaline aqueous solution in the reaction chamber and a time change rate of the temperature;

injecting the alkaline aqueous solution into the reaction chamber while feed-back controlling an injection rate thereof by calculating a time change rate of the alkali concentration together with measuring the alkali concentration;

maintaining a mixed liquid in the reaction chamber at a predetermine temperature;

treating gas P including hydrogen gas, steam, alkaline aqueous solution mist, metasilicate hydrate mist, and silicon particles by a scrubber, which has been taken out of the reaction chamber, to remove the alkaline aqueous solution mist, the metasilicate hydrate mist, and the silicon particles from the gas P; and

treating gas Q including the hydrogen gas and the steam which is obtained by treating the gas P by the scrubber to remove the steam from the gas Q by treating with a condenser.

[0007c] In a third aspect of the present disclosure, there is provided a hydrogen gas producing device, comprising in descending order:

a hermetically sealed reaction chamber;

means for supplying the reaction chamber with a silicon material A for hydrogen gas production, the silicon material A for hydrogen gas production comprising: silicon particles; oil content derived from a coolant, the oil content being 0.1 weight % to 10 weight % of the silicon particles; and water;

means for supplying the reaction chamber with an alkaline aqueous solution;

means for feed-back controlling an injection rate of the silicon material A for hydrogen gas production by measuring a temperature of a mixed liquid of the silicon material A for hydrogen gas production and the alkaline aqueous solution and calculating a time change rate of the temperature so that the temperature of the mixed liquid in the reaction chamber may be a predetermined temperature;

means for feed-back controlling an injection rate of the alkaline aqueous solution by calculating a time change rate of alkali concentration together with measuring the alkali concentration of the mixed liquid so that the alkali concentration of the mixed liquid may be a predetermined value;

means for uniformly mixing the alkaline aqueous solution with the silicon material A for hydrogen gas production provided in the reaction chamber;

a thermometer attached to the reaction chamber;

a heater attached to the reaction chamber;

a cooler attached to the reaction chamber;

a scrubber provided at an outlet of hydrogen gas in the reaction chamber;

a condenser provided at an outlet of hydrogen gas in the reaction chamber; and

a regulator provided at an outlet of hydrogen gas in the reaction chamber.

[0007d] In a fourth aspect of the present disclosure, there is provided a hydrogen gas producing device, comprising in descending order:

a hermetically sealed reaction chamber;

means for supplying the reaction chamber with a silicon material B for hydrogen gas production, the silicon material B for hydrogen gas production comprising: silicon particles; any one of formic acid, lactic acid, acetic acid, propane acid, butanoic acid, pentanoic acid, hexanoic acid, heptanoic acid, octanoic acid, nonanoic acid, decanoic acid, undecanoic acid, dodecanoic acid, tetradecanoic acid, hexadecanoic acid, heptadecanoic acid, acrylic acid, oleic acid, malic acid, citric acid, oxalic acid, maleic acid, fumaric acid, vinyl pyrrolidone, polyvinyl pyrrolidone, sodium polyacrylate, polyethylene oxide, polyethylene imide,

polyvinyl alcohol, polyacrylamide and polyethylene glycol in a range of 0.1 weight % to 10 weight % or a mixture of at least two selected therefrom, and water;

means for supplying the reaction chamber with an alkaline aqueous solution;

means for feed-back controlling an injection rate of the silicon material B for hydrogen gas production by measuring a temperature of a mixed liquid of the silicon material B for hydrogen gas production and the alkaline aqueous solution and calculating a time change rate of the temperature so that the temperature of the mixed liquid in the reaction chamber may be a predetermined temperature;

means for feed-back controlling an injection rate of the alkaline aqueous solution by measuring alkali concentration of the mixed liquid and calculating a time change rate of the alkali concentration so that the alkali concentration of the mixed liquid may be a predetermined value;

means for uniformly mixing the alkaline aqueous solution with the silicon material B for hydrogen gas production provided in the reaction chamber;

a thermometer attached to the reaction chamber;

a heater attached to the reaction chamber;

a cooler attached to the reaction chamber;

a scrubber provided at an outlet of hydrogen gas in the reaction chamber;

a condenser provided at an outlet of hydrogen gas in the reaction chamber; and

a regulator provided at an outlet of hydrogen gas in the reaction chamber.

PROBLEMS TO BE SOLVED BY THE INVENTION

[0008] The inventors of the present invention conducted an experiment for mixing silicon powders with water to supply sludge as disclosed in JP 2001-213609 A. The details of the experiment will be described later as an explanation of a comparative example of FIG. 3 of the present invention. As a result, it was impossible to inhibit a severe reaction caused immediately after contacting silicon with an alkaline aqueous solution, even when sludge is supplied in a mixture of silicon powders and water.

[0009] In a hydrogen gas producing apparatus disclosed in JP 2001-213609 A, silicon powders are mixed with water. In an actual multi-wire saw, however, silicon ingots and wires are cut while being cooled by a coolant. The coolant is not simple water but a fluid obtained by mixing propylene glycol (PG) with water, for instance. Propylene glycol makes a surface tension of water smaller to improve wettability of the wires and penetrability of the silicon ingots into slice grooves. Propylene glycol or a material having similar functions is referred to as oil content in a coolant.

[0010] Therefore, silicon waste generated from a multi-wire saw includes silicon particles and a coolant (water and oil content). In this point, "sludge obtained by mixing silicon powders with water" disclosed in JP 2001-213609 A does not contain oil content and is different from silicon

CLAIMS

1. A silicon material A for hydrogen gas production, comprising:

silicon particles;

0.1 weight % to 10 weight % of oil content contained in the silicon particles; and

water.

2. The silicon material A for hydrogen gas production according to claim 1, wherein the oil content is any one of isopropanol, 1-butanol, 2-butanol, 2-methyl-1-propanol, 2-methyl-2-propanol, 2-ethyl-1-hexanol, ethylene glycol, diethylene glycol, propylene glycol, dipropylene glycol, glycerin, 1,2-propanediol, 1,4-butanediol, 1,2-butanediol, 1,3-butanediol, 1,5-pentanediol or a mixture thereof.

3. The silicon material A for hydrogen gas production according to claim 1 or claim 2, wherein the silicon particles each have an average particle size of 0.1 μm to 30 μm.

4. The silicon material A for hydrogen gas production according to any one of claims 1 to 3, wherein the water is one time to ten times as heavy as the silicon particles.

5. A silicon material B for hydrogen gas production, comprising:

silicon particles;

a reaction inhibitor which is 0.1 weight % to 10 weight % of the silicon particles; and

water.

6. The silicon material B for hydrogen gas production according to claim 5, wherein the reaction inhibitor is any one of formic acid, lactic acid, acetic acid, propane acid, butanoic acid, pentanoic acid, hexanoic acid, heptanoic acid, octanoic acid, nonanoic acid, decanoic acid, undecanoic acid, dodecanoic acid, tetradecanoic acid, hexadecanoic acid, heptadecanoic acid, acrylic acid, oleic acid, malic acid, citric acid, oxalic acid, maleic acid, fumaric acid, vinyl pyrrolidone, polyvinyl pyrrolidone, sodium polyacrylate, polyethylene oxide, polyethylene imide, polyvinyl alcohol, polyacrylamide, polyethylene glycol or a mixture thereof.

7. The silicon material B for hydrogen gas production according to claim 5 or claim 6, wherein the silicon particles each have an average particle size of 0.1 μm to 30 μm.

8. The silicon material B for hydrogen gas production according to any one of claims 5 to 7, wherein the water is one to 10 times as heavy as the silicon particles.

9. A method for producing a silicon material A for hydrogen gas production, comprising the steps of:

preparing silicon waste comprising silicon particles, oil content and water derived from a coolant;

centrifuging or filtering the silicon waste to produce a solid A composed of the silicon particles, the oil content that is 0.1 weight% to 10 weight% of the silicon particles, and a small amount of the water;

drying the solid A to produce a solid B composed of the silicon particles and the oil content that is 0.1 weight% to 10 weight% of the silicon particles; and

adding water to the solid B to produce sludge A.

10. The method for producing a silicon material A for hydrogen gas production according to claim 9, wherein the oil content is any one of isopropanol, 1-butanol, 2-butanol, 2-methyl-1-propanol, 2-methyl-2-propanol, 2-ethyl-1-hexanol, ethylene glycol, diethylene glycol, propylene glycol, dipropylene glycol, glycerin, 1,2-propanediol, 1,4-butanediol, 1,2-butanediol, 1,3-butanediol, 1,5-pentanediol or a mixture thereof.

11. The method for producing a silicon material A for hydrogen gas production according to claim 9 or claim 10, wherein the solid A has a drying temperature of 100°C to 120°C.

12. A method for producing a silicon material B for hydrogen gas production, comprising the steps of:

preparing silicon waste comprising silicon particles, oil content and water derived from a coolant;

centrifuging or filtering the silicon waste to produce a solid A composed of the silicon particles, the oil content, and a small amount of the water;

drying the solid A to produce a solid B composed of the silicon particles and the oil content;

evaporating the oil content by drying the solid B at a high temperature to produce a solid C composed of silicon particles; and

adding a reaction inhibitor which is 0.1 weight % to 10 weight% of the silicon particles and water to the solid C to produce sludge B.

13. The method for producing a silicon material B for hydrogen gas production according to claim 12, wherein the reaction inhibitor is any one of isopropanol, 1-butanol, 2-butanol, 2-methyl-1-propanol, 2-methyl-2-propanol, 2-ethyl-1-hexanol, ethylene glycol, diethylene glycol, propylene glycol, dipropylene glycol, glycerin, 1,2-propanediol, 1,4-

butanediol, 1,2-butanediol, 1,3-butanediol, 1,5-pentanediol, formic acid, lactic acid, acetic acid, propane acid, butanoic acid, pentanoic acid, hexanoic acid, heptanoic acid, octanoic acid, nonanoic acid, decanoic acid, undecanoic acid, dodecanoic acid, tetradecanoic acid, hexadecanoic acid, heptadecanoic acid, acrylic acid, oleic acid, malic acid, citric acid, oxalic acid, maleic acid, fumaric acid, vinyl pyrrolidone, polyvinyl pyrrolidone, sodium polyacrylate, polyethylene oxide, polyethylene imide, polyvinyl alcohol, polyacrylamide, polyethylene glycol or a mixture thereof.

14. The method for producing a silicon material B for hydrogen gas production according to claim 12 or claim 13, wherein the solid A has a drying temperature of 100°C to 120°C.

15. The method for producing a silicon material B for hydrogen gas according to any one of claims 12 to 14, wherein the solid B has a high-temperature drying temperature of 500°C to 700°C.

16. A method for producing hydrogen gas, comprising the steps of:

preparing one of a silicon material A for hydrogen gas production according to any one of claims 1 to 4 and a

silicon material B for hydrogen gas production according to any one of claims 5 to 8;

preparing an alkaline aqueous solution;

injecting one of the silicon material A for hydrogen gas production and the silicon material B for hydrogen gas production into a reaction chamber while feed-back controlling an injection rate thereof based on a temperature of a mixed liquid in the reaction chamber;

injecting the alkaline aqueous solution into the reaction chamber while feed-back controlling an injection rate thereof based on an alkali concentration in the reaction chamber;

maintaining a mixed liquid of one of the silicon material A for hydrogen gas production and the silicon material B for hydrogen gas production, and the alkaline aqueous solution in the reaction chamber at a predetermine temperature;

Treating gas P including hydrogen gas, steam, alkaline aqueous solution mist, metasilicate hydrate mist, and silicon particles by a scrubber, which has been taken out of the reaction chamber, to remove the alkaline aqueous solution mist, the metasilicate hydrate mist, and the silicon particles from the gas P; and

treating gas Q including the hydrogen gas and the steam which is obtained by treating the gas P by the scrubber to remove the steam from the gas Q by treating with a condenser.

17. The method for producing hydrogen gas according to claim 16, wherein the alkaline aqueous solution is one of a NaoH aqueous solution and a KOH aqueous solution.

18. The method for producing hydrogen gas according to claim 17, wherein one of the NaoH aqueous solution and the KOH aqueous solution has a concentration of 1 mol/L to 8 mol/L.

19. The method for producing hydrogen gas according to any one of claims 16 to 18, wherein the predetermined temperature is 50°C to 90°C.

20. A hydrogen gas producing device, comprising in descending order:

a hermetically sealed reaction chamber;

means for supplying the reaction chamber with one of a silicon material A for hydrogen gas production according to any one of claims 1 to 4 and a silicon material B for hydrogen gas production according to any one of claims 5 to 8;

means for supplying the reaction chamber with an alkaline aqueous solution;

a thermometer fitted to the reaction chamber;

a heater equipped fitted to the reaction chamber;

a cooler equipped fitted to the reaction chamber;

a scrubber provided at an outlet of hydrogen gas in the reaction chamber;

a condenser provided at an outlet of hydrogen gas in the reaction chamber; and

a regulator provided at an outlet of hydrogen gas in the reaction chamber.

21. The hydrogen gas producing device according to claim 20, wherein the scrubber removes alkaline aqueous mist, metasilicate hydrate mist, and silicon particles from the reaction chamber.

22. The hydrogen gas producing device according to claim 20 or claim 21, wherein the means for supplying one of the silicon material A for hydrogen gas production and the silicon material B for hydrogen gas production is one of a mono pump and a gear pump.

23. The hydrogen gas producing device according to any one of claims 20 to 22, wherein the reaction chamber includes means for mixing the alkaline aqueous solution with one of the silicon material A for hydrogen gas production and the silicon material B for hydrogen gas production.

CLAIMS

1. A method for producing hydrogen gas, comprising the steps of:

preparing a silicon material A for hydrogen gas production, the silicon material A for hydrogen gas production comprising: silicon particles; oil content derived from a coolant, the oil content being 0.1 weight % to 10 weight % of the silicon particles; and water;

preparing an alkaline aqueous solution;

supplying the silicon material A for hydrogen gas production and the alkaline aqueous solution in a reaction chamber;

injecting the silicon material A for hydrogen gas production into the reaction chamber while feed-back controlling an injection rate thereof based on a temperature of a mixed liquid of the silicon material A for hydrogen gas production and the alkaline aqueous solution in the reaction chamber and a time change rate of the temperature;

injecting the alkaline aqueous solution into the reaction chamber while feed-back controlling an injection rate thereof by measuring alkali concentration of the mixed liquid and calculating a time change rate of the alkali concentration;

maintaining the mixed liquid in the reaction chamber at a predetermine temperature;

treating gas P including hydrogen gas, steam, alkaline aqueous solution mist, metasilicate hydrate mist, and silicon particles by a scrubber, which has been taken out of the reaction chamber, to remove the alkaline aqueous solution mist, the metasilicate hydrate mist, and the silicon particles from the gas P; and

treating gas Q including the hydrogen gas and the steam which is obtained by treating the gas P by the scrubber to remove the steam from the gas Q by treating with a condenser.

2. The method for producing hydrogen gas according to claim 1, wherein the oil content is any one of 1-butanol, 2-methyl-1-propanol, 2-ethyl-1-hexanol, ethylene glycol, diethylene glycol, propylene glycol, dipropylene glycol, glycerin, 1,2-propanediol, 1,4-butanediol, 1,2-butanediol, 1,3-butanediol and 1,5-pentanediol or a mixture of at least two selected therefrom.

3. The method for producing hydrogen gas according to claim 1 or claim 2, wherein the silicon particles each have an average particle size of 0.1 μm to 30 μm.

4. The method for producing hydrogen gas according to any one of claims 1 to 3, wherein the water is one time to ten times as heavy as the silicon particles.

5. A method for producing hydrogen gas, comprising the steps of:

preparing a silicon material B for hydrogen gas production comprising: silicon particles; any one of formic acid, lactic acid, acetic acid, propane acid, butanoic acid, pentanoic acid, hexanoic acid, heptanoic acid, octanoic acid, nonanoic acid, decanoic acid, undecanoic acid, dodecanoic acid, tetradecanoic acid, hexadecanoic acid, heptadecanoic acid, acrylic acid, oleic acid, malic acid, citric acid, oxalic acid, maleic acid, fumaric acid, vinyl pyrrolidone, polyvinyl pyrrolidone, sodium polyacrylate, polyethylene oxide, polyethylene imide, polyvinyl alcohol, polyacrylamide and polyethylene glycol in a range of 0.1 weight % to 10 weight % or a mixture of at least two selected therefrom, and water;

preparing an alkaline aqueous solution;

supplying the reaction chamber with the silicon material B and the alkaline aqueous solution;

injecting the silicon material B for hydrogen gas production into the reaction chamber while feed-back controlling an injection rate thereof based on a temperature of a mixed liquid of the silicon material B for hydrogen gas production and the alkaline aqueous solution in the reaction chamber and a time change rate of the temperature;

injecting the alkaline aqueous solution into the reaction chamber while feed-back controlling an injection

rate thereof by calculating a time change rate of the alkali concentration together with measuring the alkali concentration;

maintaining a mixed liquid in the reaction chamber at a predetermine temperature;

treating gas P including hydrogen gas, steam, alkaline aqueous solution mist, metasilicate hydrate mist, and silicon particles by a scrubber, which has been taken out of the reaction chamber, to remove the alkaline aqueous solution mist, the metasilicate hydrate mist, and the silicon particles from the gas P; and

treating gas Q including the hydrogen gas and the steam which is obtained by treating the gas P by the scrubber to remove the steam from the gas Q by treating with a condenser.

6. The method for producing hydrogen gas according to claim 5, wherein the silicon particles each have an average particle size of 0.1 μm to 30 μm.

7. The method for producing hydrogen gas according to claim 5 or claim 6, wherein the water is one time to ten times as heavy as the silicon particles.

8. The method for producing hydrogen gas according to any one of claims 1 to 7, wherein the alkaline aqueous solution is one of a NaoH aqueous solution and a KOH aqueous solution.

9. The method for producing hydrogen gas according to claim 8, wherein the alkaline aqueous solution is one of the NaoH aqueous solution and the KOH aqueous solution which has a concentration of 1 mol/L to 8 mol/L.

10. The method for producing hydrogen gas according to any one of claims 1 to 9, wherein the predetermined temperature is 50°C to 90°C.

11. A hydrogen gas producing device, comprising in descending order:

a hermetically sealed reaction chamber;

means for supplying the reaction chamber with a silicon material A for hydrogen gas production, the silicon material A for hydrogen gas production comprising: silicon particles; oil content derived from a coolant, the oil content being 0.1 weight % to 10 weight % of the silicon particles; and water;

means for supplying the reaction chamber with an alkaline aqueous solution;

means for feed-back controlling an injection rate of the silicon material A for hydrogen gas production by measuring a temperature of a mixed liquid of the silicon material A for hydrogen gas production and the alkaline aqueous solution and calculating a time change rate of the

temperature so that the temperature of the mixed liquid in the reaction chamber may be a predetermined temperature;

means for feed-back controlling an injection rate of the alkaline aqueous solution by calculating a time change rate of alkali concentration together with measuring the alkali concentration of the mixed liquid so that the alkali concentration of the mixed liquid may be a predetermined value;

means for uniformly mixing the alkaline aqueous solution with the silicon material A for hydrogen gas production provided in the reaction chamber;

a thermometer attached to the reaction chamber;

a heater attached to the reaction chamber;

a cooler attached to the reaction chamber;

a scrubber provided at an outlet of hydrogen gas in the reaction chamber;

a condenser provided at an outlet of hydrogen gas in the reaction chamber; and

a regulator provided at an outlet of hydrogen gas in the reaction chamber.

12. The hydrogen gas producing device according to claim 11, wherein the oil content derived from the coolant is any one of 1-butanol, 2-methyl-1-propanol, 2-ethyl-1-hexanol, ethylene glycol, diethylene glycol, propylene glycol, dipropylene glycol, glycerin, 1,2-propanediol, 1,4-

butanediol, 1,2-butanediol, 1,3-butanediol and 1,5-pentanediol or a mixture of at least two selected therefrom.

13. The hydrogen gas producing device according to claim 11 or claim 12, wherein the silicon particles each have an average particle size of 0.1 μm to 30 μm.

14. The hydrogen gas producing device according to any one of claims 11 to 13, wherein the water is one time to ten times as heavy as the silicon particles.

15. The hydrogen gas producing device according to claims 11 to 14, wherein the scrubber removes the alkaline aqueous solution mist, the metasilicate hydrate mist, and the silicon particles from the reaction chamber.

16. The hydrogen gas producing device according to claims 11 to 15, wherein the means for supplying the silicon material A for hydrogen gas production is one of a mono pump and a gear pump.

17. A hydrogen gas producing device, comprising in descending order:

a hermetically sealed reaction chamber;

means for supplying the reaction chamber with a silicon material B for hydrogen gas production, the silicon material B for hydrogen gas production comprising: silicon

particles; any one of formic acid, lactic acid, acetic acid, propane acid, butanoic acid, pentanoic acid, hexanoic acid, heptanoic acid, octanoic acid, nonanoic acid, decanoic acid, undecanoic acid, dodecanoic acid, tetradecanoic acid, hexadecanoic acid, heptadecanoic acid, acrylic acid, oleic acid, malic acid, citric acid, oxalic acid, maleic acid, fumaric acid, vinyl pyrrolidone, polyvinyl pyrrolidone, sodium polyacrylate, polyethylene oxide, polyethylene imide, polyvinyl alcohol, polyacrylamide and polyethylene glycol in a range of 0.1 weight % to 10 weight % or a mixture of at least two selected therefrom, and water;

means for supplying the reaction chamber with an alkaline aqueous solution;

means for feed-back controlling an injection rate of the silicon material B for hydrogen gas production by measuring a temperature of a mixed liquid of the silicon material B for hydrogen gas production and the alkaline aqueous solution and calculating a time change rate of the temperature so that the temperature of the mixed liquid in the reaction chamber may be a predetermined temperature;

means for feed-back controlling an injection rate of the alkaline aqueous solution by measuring alkali concentration of the mixed liquid and calculating a time change rate of the alkali concentration so that the alkali concentration of the mixed liquid may be a predetermined value;

means for uniformly mixing the alkaline aqueous solution with the silicon material B for hydrogen gas production provided in the reaction chamber;

a thermometer attached to the reaction chamber;

a heater attached to the reaction chamber;

a cooler attached to the reaction chamber;

a scrubber provided at an outlet of hydrogen gas in the reaction chamber;

a condenser provided at an outlet of hydrogen gas in the reaction chamber; and

a regulator provided at an outlet of hydrogen gas in the reaction chamber.

18. The hydrogen gas producing device according to claim 17, wherein the silicon particles each have an average particle size of 0.1 μm to 30 μm.

19. The hydrogen gas producing device according to claim 17 or claim 18, wherein the water is one time to ten times as heavy as the silicon particles.

20. The hydrogen gas producing device according to any one of claims 17 to 19, wherein the scrubber removes alkaline aqueous mist, metasilicate hydrate mist, and silicon particles from the reaction chamber.

21. The hydrogen gas producing device according to any one of claims 17 to 20, wherein the means for supplying the

silicon material B for hydrogen gas production is one of a mono pump and a gear pump.