CLAIMS

1. A process for the formation of nickel silicide or of cobalt silicide comprising the stages consisting in:

- bringing the surface of a silicon-comprising substrate into contact with an aqueous solution comprising gold ions and fluorine ions in order to form particles of metallic gold,
- depositing by an electroless route, on the substrate covered with particles of metallic gold, a layer essentially composed of nickel or of cobalt,
- applying a rapid thermal annealing at a temperature of between 300°C and 750°C, so as to form the nickel silicide or the cobalt silicide,

characterized in that the aqueous solution comprises a surface-active agent chosen from the compounds comprising at least one anionic or nonionic polar group and an alkyl chain comprising from 10 to 16 carbon atoms.

2. The process as claimed in claim 1, characterized in that the surface of the silicon-comprising substrate is brought into contact with the aqueous solution for a duration of between 5 seconds and 5 minutes.

3. The process as claimed in either of the preceding claims, characterized in that the fluorine ions are contributed by hydrofluoric acid (HF), NH_4F or one of their mixtures.

4. The process as claimed in one of the preceding claims, characterized in that the gold ions are contributed by chloroauric acid ($HAuCl_4$).

5. The process as claimed in one of the preceding claims, characterized in that the aqueous solution comprises:

- from 0.1 mM to 10 mM, preferably from 0.5 mM to 1.0 mM, of gold ions, and
- from 0.6 M to 3.0 M, preferably from 1.0 M to 2.0 M, of fluorine ions.

6. The process as claimed in one of the preceding claims, characterized in that the alkyl chain comprises from 10 to 14 carbon atoms.

7. The process as claimed in one of the preceding claims, characterized in that the layer essentially composed of nickel or of cobalt has a uniform or conformal thickness of between 10 and 150 nm, preferably between 10 and 60 nm.

8. The process as claimed in one of the preceding claims, characterized in that the layer essentially composed of nickel or of cobalt is a nickel-boron layer deposited by exposing the surface of the activated substrate to an aqueous solution comprising a nickel salt, a boron-based reducing agent, a stabilizing

agent for nickel and a polyamine, the pH of the solution being between 9 and 12 and the temperature of the aqueous solution being between 50°C and 90°C.

9. The process as claimed in one of the preceding claims, characterized in that the silicon substrate to be coated comprises hollow vertical structures exhibiting dimensions such that their diameter at the opening is between 20 and 100 nm and their depth is between 500 nm and 3 microns.

10. The process as claimed in one of the preceding claims, characterized in that the silicon-comprising substrate comprises a vertical alternation at its surface of regions of silicon and of regions of a dielectric chosen from SiO_2, Si_3N_4, SiC and SiOC.

11. The process as claimed in one of the preceding claims, characterized in that the nickel or the cobalt which has not migrated into the silicon on conclusion of the thermal annealing stage can be removed by chemical cleaning.

12. The process as claimed in one of the preceding claims, characterized in that the thermal annealing temperature ranges from 350°C to 450°C.

13. The process as claimed in one of the preceding claims, characterized in that the surface-active agent has a molecular weight of between 100 g/mol and 1500 g/mol.

14. The process as claimed in the preceding claim, characterized in that the surface-active agent comprises an anionic polar group.

15. The process as claimed in claim 13 or 14, characterized in that the surface-active agent is sodium dodecylsulfate.

16. A process for the formation of a nickel or cobalt layer on a silicon substrate, comprising the stages consisting in:

- exposing the surface of the silicon-comprising substrate with an aqueous solution comprising gold ions, fluorine ions and a surface-active agent chosen from compounds comprising at least one anionic or nonionic polar group and an alkyl chain comprising from 10 to 16 carbon atoms, and
- depositing by an electroless route, on the activated substrate, a layer essentially composed of nickel or of cobalt and with a thickness of between 10 and 150 nm.

17. A process for the manufacture of a NAND memory comprising a process for the formation of nickel silicide or of cobalt silicide as defined in one of claims 1 to 15.

18. A process for the manufacture of photovoltaic cells comprising a process for the formation of nickel silicide or of cobalt silicide as defined in one of claims 1 to 15.

CLAIMS

1. A process for forming nickel silicide or cobalt silicide on a silicon-comprising substrate, said process comprising the steps consisting in:

- bringing a surface of the silicon-comprising substrate into contact with an aqueous solution comprising gold ions and fluoride ions in order to form particles of metallic gold on the said surface, wherein the aqueous solution comprises a surface-active agent selected in the group consisting of compounds comprising at least one anionic or one nonionic polar group, and one alkyl chain comprising from 10 to 16 carbon atoms,

- depositing - by an electroless route - a layer essentially composed of nickel or of cobalt, on the said surface covered with particles of metallic gold that has been obtained according to the preceding step,

- applying a rapid thermal annealing at a temperature of between 300°C and 750°C, so as to form nickel silicide or cobalt silicide.

2. The process as claimed in claim 1, wherein the surface of the silicon-comprising substrate is brought into contact with the aqueous solution for a duration of between 5 seconds and 5 minutes.

3. The process as claimed in either of the preceding claims, wherein the aqueous solution comprising fluoride ions is obtained by a step of incorporating hydrofluoric acid (HF), NH_4F or one of their mixtures, into water.

4. The process as claimed in one of the preceding claims, wherein the aqueous solution comprising gold ions is obtained by a step of incorporating chloroauric acid ($HAuCl_4$) into water.

5. The process as claimed in one of the preceding claims, wherein the aqueous solution comprises:

- from 0.1 mM to 10 mM of gold ions, and
- from 0.6 M to 3.0 M of fluoride ions.

6. The process as claimed in one of the preceding claims, wherein the alkyl chain comprises from 10 to 14 carbon atoms.

7. The process as claimed in one of the preceding claims, wherein the layer essentially composed of nickel or of cobalt has a uniform or conformal thickness of between 10 and 150 nm.

8. The process as claimed in one of the preceding claims, wherein the layer essentially composed of nickel or of cobalt is a nickel-boron layer that is obtained by a step of bringing into contact the surface of the said surface covered with particles of metallic gold with an aqueous solution comprising a

nickel salt, a boron-based reducing agent, a stabilizing agent for nickel, and a polyamine, the pH of the solution being between 9 and 12 and the temperature of the aqueous solution being between 50°C and 90°C.

9. The process as claimed in one of the preceding claims, wherein silicon-comprising substrate comprises hollow vertical structures exhibiting dimensions such that their diameter at the opening is between 20 and 100 nm and their depth is between 500 nm and 3 microns.

10. The process as claimed in one of the preceding claims, wherein the silicon-comprising substrate comprises a vertical alternation at the said surface of regions of silicon and of regions of a dielectric chosen from SiO_2, Si_3N_4, SiC and SiOC.

11. The process as claimed in one of the preceding claims, further comprising a step of chemical cleaning of nickel silicide or cobalt silicide, so as to remove nickel or cobalt which has not migrated into the silicon at the end of the rapid thermal annealing stage.

12. The process as claimed in one of the preceding claims, wherein the rapid thermal annealing temperature ranges from 350°C to 450°C.

13. The process as claimed in one of the preceding claims, wherein the surface-active agent has a molecular weight of between 100 g/mol and 1500 g/mol.

14. The process as claimed in the preceding claim, wherein the surface-active agent comprises an anionic polar group.

15. The process as claimed in claim 13 or 14, wherein the surface-active agent is sodium dodecylsulfate.

16. A process for forming a layer that is essentially composed of nickel or of cobalton a silicon-comprising substrate, said process comprising the steps of:

- exposing a surface of the silicon-comprising substrate with an aqueous solution comprising gold ions, fluoride ions and a surface-active agent chosen in the group consisting of compounds comprising at least one anionic or nonionic polar group, and one alkyl chain comprising from 10 to 16 carbon atoms, so as to activate the said surface of the silicon-comprising substrate, and

- depositing - by an electroless route - on the activated surface of the silicon-comprising substrate, a layer essentially composed of nickel or of cobalt that has a thickness of between 10 and 150 nm.

17. A process for the manufacture of a NAND memory comprising a process for the formation of nickel silicide or of cobalt silicide as defined in one of claims 1 to 15.

18. A process for the manufacture of photovoltaic cells comprising a process for the formation of nickel silicide or of cobalt silicide as defined in one of claims 1 to 15.