Claims

1. A method for depositing an aluminium nitride layer on a silicon substrate, comprising:
providing a silicon substrate;
placing the substrate in a vacuum chamber;
conditioning a surface of the substrate by etching and providing a conditioned surface;
heating the substrate to a temperature T_1;
depositing an aluminium film onto the conditioned surface of the substrate by a sputtering method under an atmosphere of Argon; and
depositing an epitaxial aluminium nitride layer on the aluminium film by a sputtering method under an atmosphere of Nitrogen and Argon,
wherein the conditioning the surface of the substrate comprises plasma soft-etching the surface under vacuum,
wherein the plasma soft-etching comprises heating the substrate to a temperature T_2, introducing Ar gas into the vacuum chamber and subjecting the surface of the substrate to a plasma, and
the method further comprising reducing the pressure in the vacuum chamber after the conditioning.

2. The method according to claim 1, wherein T_2 is 35°C to 70°C.

3. The method according to claim 1 or 2, wherein the plasma soft-etching is carried out at a pressure of 2.10^{-4} mbar to 8.10^{-4} with a RF plasma comprising Ar+ ions.

4. The method according to one of claims 1 to 3, wherein $T_2 < T_1$.

5. The method according to one of claims 1 to 4, wherein the providing of the silicon substrate includes the providing of a <111> silicon substrate .

6. The method according to one of claims 1 to 5, wherein the etching comprises preferentially removing chemically bound oxygen from the substrate.

7. The method according to one of claims 1 to 6, wherein after the depositing of the aluminium film the surface is mainly Al-terminated.

8. The method according to one of claims 1 to 7, further comprising subjecting the conditioned surface to a hydrogen containing gas flow in the vacuum chamber after the conditioning.

9. The method according to one of claims 1 to 5, wherein T_1 lies in the range 650°C to 800°C.

10. The method according to one of claims 1 to 9, further comprising flowing Argon gas over the substrate whilst the substrate is heated up to the temperature T_1.

11. The method according to one of claims 1 to 10, wherein the conditioning is carried out in a first vacuum chamber and the depositing is carried out in a second vacuum chamber.

12. The method according to one of claims 1 to 11, wherein the aluminium film is deposited onto the conditioned surface of the substrate by DC sputtering.

13. The method according to claim 12, wherein a DC power of approximately 100 W is used to sputter the aluminium film onto the conditioned surface.

14. The method according to one of claims 1 to 13, wherein the aluminium nitride layer is deposited onto the aluminium film by reactive sputtering.

15. The method according to claim 14, wherein a DC power of approximately 1.0 to 3 kW is used to sputter the aluminium nitride layer onto the aluminium film.

16. The method according to one of claims 1 to 15, further comprising actively cooling the substrate after depositing the aluminium nitride layer.