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(54) Title: ADHESION AND ELECTROMIGRATION IMPROVEMENT BETWEEN DIELECTRIC AND CONDUCTIVE LAYERS

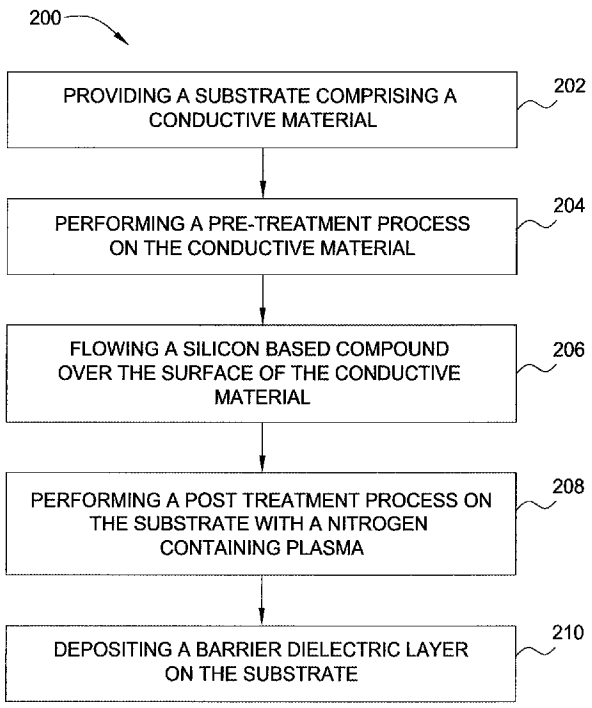

FIG. 2

(57) Abstract: A method and apparatus for processing a substrate is provided. The method of processing a substrate includes providing a substrate comprising a conductive material, performing a pre-treatment process on the conductive material, flowing a silicon based compound on the conductive material to form a silicide layer, performing a post treatment process on the silicide layer, and depositing a barrier dielectric layer on the substrate.

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1. A method for processing a substrate comprising a conductive material, comprising:

performing a pre-treatment process on the conductive material;

flowing a first gas mixture comprising a silicon based compound over the conductive material disposed on the substrate;

forming a silicide layer on the substrate from the first gas mixture;

flowing a second gas mixture subsequent to the first gas mixture to perform a post treatment process on the silicide layer formed from the first gas mixture, the second gas mixture comprising NH_3 gas; and

depositing a barrier dielectric layer on the substrate.

2. The method of claim 1, wherein the conductive material comprises copper.

3. The method of claim 1, wherein the silicide layer comprises silicon nitride.

4. The method of claim 1, wherein the barrier layer comprises silicon carbide.

5. The method of claim 1, wherein performing the post treatment process includes:

performing a plasma nitridation process to the surface of the conductive material.

6. The method of claim 5, wherein performing the post treatment process includes:

forming a metal nitrosilicide layer on the substrate.

7. The method of claim 6, wherein the metal nitrosilicide layer is a copper silicon nitride layer.

8. The method of claim 7, wherein the copper silicon nitride layer is between about 1 Å and about 100 Å thick.

9. A method for processing a substrate comprising a conductive material, comprising:

flowing a first gas mixture comprising a silicon based compound over the surface of the conductive material;

forming a silicide layer on the substrate from the first gas mixture;

flowing a second gas mixture comprising NH_3 subsequent to the first gas mixture to treat the silicide layer with a plasma present in the second gas mixture to form a metal nitrosilicide layer; and

depositing a barrier layer on the substrate.

10. The method of claim 9, wherein the conductive material comprises copper, and the silicide layer comprises silicon nitride.

11. The method of claim 9, wherein the barrier layer comprises silicon carbide.

12. The method of claim 9, wherein the metal nitrosilicide layer comprises copper silicon nitride.

13. The method of claim 9, wherein the plasma is formed by applying RF power to the second gas mixture.

14. The method of claim 13, wherein applying RF power comprises maintaining the RF power while forming the metal nitrosilicide layer on the substrate.

15. A method for processing a substrate comprising a conductive material, comprising:

performing a nitrogen pre-treatment process by exposing the conductive material to NH_3 gas;

flowing a first gas mixture comprising silane gas over the surface of the conductive material;

forming a silicide layer on the substrate surface from the first gas mixture;

treating the silicide layer with NH_3 gas containing plasma to form a metal nitrosilicide; and

depositing a barrier dielectric layer comprising silicon carbide on the nitrosilicide.