Claims

What is claimed is

1. A method for depositing vanadium-containing films comprising the steps of:

(i) contacting a substrate with vanadium oxytrichloride vapor in a deposition reactor;

(ii) purging unreacted vanadium oxytrichloride with a first inert gas;

(iii) contacting the substrate with a nitrogen containing reactant in the deposition reactor;

(iv) optionally purging unreacted nitrogen containing reactant with a second inert gas; and

(v) optionally treating the substrate with plasma.

2. The method of claim 1, wherein the step of (i) contacting the substrate with vanadium oxytrichloride vapor comprises pulsing the vanadium oxytrichloride vapor for about 0.1 seconds to about 3 seconds.

3. The method of claim 1, wherein the step of (ii) purging unreacted vanadium oxytrichloride with the first inert gas comprises a purge time of about 1 seconds to about 90 seconds.

4. The method of claim 1, wherein the step (iii) nitrogen containing reactant comprises one or more of ammonia, hydrazine, monoalkylhydriazine and dialkylhydrazine.

5. The method of claim 1, wherein the step (iii) nitrogen containing reactant comprises ammonia.

6. The method of claim 1, wherein the step of (iii) contacting the substrate with ammonia gas comprises pulsing the nitrogen containing reactant for about 0.5 seconds to about 5 seconds.

7. The method of claim 1, wherein the step of (iv) optionally purging of any unreacted nitrogen containing reactant with the second inert gas comprises a purge time of about 15 seconds to about 90 seconds.

8. The method of claim 1, wherein the step of (v) treating the substrate with plasma to remove residual oxygen from oxynitride film comprises treatment with nitrogen (N_2) plasma or hydrogen (H_2) plasma.

9. The method of claim 1, wherein the substrate comprises silicon oxide.

10. The method of claim 1, wherein the substrate comprises aluminum oxide.

11. The method of claim 1, wherein the substrate comprises titanium nitride.

12. The method of claim 1, wherein the substrate comprises titanium oxide.

13. The method of claim 1, wherein the substrate comprises zirconium oxide.

14. The method of claim 1, wherein the substrate is heated to a temperature from about 300 ^{O}C to about 600 ^{O}C.

15. The method of claim 1, wherein the deposition reactor is at a pressure ≤ about 50 torr.

16. A vanadium-containing film deposited by the process of claim 1.

17. A vanadium-containing film deposited by the process of claim 1, wherein the film has an aspect ratio of about 1 to about 60.

18. A vanadium-containing film deposited by the process of claim 1, wherein the film has a resistivity of between about 150 to about 500 μOhm cm.

19. A vanadium-containing film deposited by the process of claim 1, wherein the film comprises vanadium nitride.

20. A vanadium-containing film deposited by the process of claim 1, wherein the film comprises vanadium oxynitride.