CLAIMS

What is claimed is:

1. A method, comprising:

depositing an oxide gapfill material into patterned features of a layer of a substrate using a hydrogen-containing oxidizing chemistry, wherein the deposited oxide gapfill material has a plurality of seams within the patterned features; and

thermally treating the deposited oxide gapfill material in the presence of hydrogen-containing compounds and/or oxygen-containing compounds to thereby reduce the extent of the seams.

2. The method of claim 1, wherein depositing the oxide gapfill material is performed by an atomic layer deposition (ALD) process.

3. The method of claim 2, wherein the ALD process comprises one or more cycles of:

flowing oxide gapfill precursor, and

flowing an oxidizing chemistry comprising H_2 and O_2.

4. The method of claim 3, wherein the oxidizing chemistry additionally comprises N_2O, CO_2, H_2O, or combinations thereof.

5. The method of claim 3, wherein a ratio of volumetric flow rate between H_2 and O_2 when flowing the oxidizing chemistry is between about 1:10 and about 1:1.

6. The method of claim 3, wherein the oxide gapfill precursor includes aminosilanes, halosilanes, alkylsilanes, silane, or combinations thereof.

7. The method of claim 1, wherein depositing the oxide gapfill material is performed by a chemical vapor deposition process.

8. The method of claim 1, wherein the oxide gapfill material is silicon oxide.

9. The method of claim 1, wherein an aspect ratio of the patterned features is between about 5:1 and about 80:1.

10. The method of claim 1, wherein thermally treating the deposited oxide gapfill material is performed at a temperature of at least about 400°C.

11. The method of claim 1, wherein thermally treating the deposited oxide gapfill material is performed at a temperature between about 400°C and about 850°C.

12. The method of any one of claims 1-11, wherein thermally treating the deposited oxide gapfill material is performed under conditions that form H_2O.

13. The method of any one of claims 1-11, wherein thermally treating the deposited oxide gapfill material is performed in the presence of H_2 and O_2.

14. The method of claim 13, wherein a volumetric ratio of H_2 to O_2 during thermally treating the deposited oxide gapfill material is between about 10:1 and about 1:1.

15. The method of any one of claims 1-11, wherein the oxygen-containing compounds include N_2O, CO_2, H_2O, or combinations thereof.

16. The method of any one of claims 1-11, wherein the hydrogen-containing compounds include protic acids.

17. The method of any one of claims 1-11, wherein a hydrogen % within the deposited oxide gapfill material prior to thermally treating the deposited oxide gapfill material is at least about 0.1%.

18. The method of any one of claims 1-11, wherein the layer includes polySi-SiO_2, W-SiO_2, SiN-SiO_2, SiNO-SiO_2, SiCO-SiO_2, SiC-SiO_2, Ta-SiO_2, Ta, Hf, Zr, Ge, GeO_2, Al_2O3, TiO_2, NiO, CoO, Co_2O, MoO_3, HfO, TaO or combinations thereof.

19. A method, comprising:

receiving a substrate having patterned features within a first layer;

depositing a oxide gapfill material into the patterned features; and

thermally treating the deposited oxide gapfill material in the presence of hydrogen-containing compounds and/or oxygen-containing compounds.

20. A method, comprising:

prior to thermally treating a substrate, depositing an oxide gapfill material into patterned features of the substrate by an atomic layer deposition (ALD) process, wherein the ALD process comprises one or more cycles of:

flowing gapfill precursor, and

flowing an oxidizing chemistry comprising H_2 and O_2.

21. A method, comprising:

receiving a substrate having a patterned first layer filled with oxide gapfill material having seams within the oxide gapfill material; and

thermally treating the oxide gapfill material in the presence of hydrogen-containing compounds and/or oxygen-containing compounds to thereby reduce the extent of the seams.

22. The method of claim 21, wherein the oxide gapfill material is deposited using a hydrogen-containing oxide chemistry.