Claims:

1. A method of forming a metal containing layer on a substrate comprising:

supplying an oxygen containing gas mixture on a substrate in a processing chamber, the substrate comprising a metal containing layer disposed on an optically transparent substrate;

maintaining the oxygen containing gas mixture in the processing chamber at a process pressure between 2 bar and 50 bar; and

thermally annealing the metal containing layer in the presence of the oxygen containing gas mixture.

2. The method of claim 1, wherein supplying the oxygen containing gas mixture further comprises:

maintaining a substrate temperature at less than 400 degrees Celsius.

3. The method of claim 1, wherein oxygen containing gas mixture includes at least an oxygen containing gas selected from a group consisting of O3 gas, O2 gas, H2O, H2O2, N2O, NO2, CO2, CO, air, and dry steam.

4. The method of claim 1, wherein oxygen containing gas mixture includes dry steam or air.

5. The method of claim 1, wherein the process pressure is between about 5 bar and 100 bar.

6. The method of claim 1, wherein the metal containing layer is a metal oxide layer.

7. The method of claim 6, wherein the metal oxide layer is selected from a group consisting of a-IGZO (amorphous indium gallium zinc oxide), doped IGZO, InGaZnON, ZnO, ZnON, ZnSnO, CdSnO, GaSnO, TiSnO, CuBO2, CuAlO2, CuGaO2, SrCuO, LaCuOS, GaN, InGaN, AlGaN and InGaAlN.

8. The method of claim 1, further comprising:

implanting dopants into the metal containing layer prior to supplying the oxygen containing gas mixture.

9. The method of claim 8, wherein the dopants implanted into the metal containing layer comprises indium or molybdenum.

10. The method of claim 9, wherein the dopants implanted into the metal containing layer increase crystallinity of the metal containing layer.

11. The method of claim 1, wherein the metal containing layer is an active layer in a TFT device structure.

12. The method of claim 1, wherein the metal containing layer is InGaZnON.

13. The method of claim 1, wherein the metal containing layer is an electrode in a TFT device structure.

14. The method of claim 1, wherein the metal containing layer has a higher mobility after the thermally annealing.

15. The method of claim 1, wherein the metal containing layer has a higher film density after the thermally annealing.

16. A method for densifying a metal containing layer comprising:

thermally treating a metal containing layer disposed on an optically transparent substrate at a pressure between 2 bar and 50 bar; and

maintaining a substrate temperature less than 500 degrees Celsius during thermally treating the metal containing layer.

17. The method of claim 16, further comprising:

supplying dry steam, air, chalcogen vapor or tellurium vapor to the metal containing layer while thermally treating the metal containing layer.

18. The method of claim 16, wherein the metal containing layer is selected from a group consisting of a-IGZO (amorphous indium gallium zinc oxide), doped IGZO, InGaZnON, ZnO, ZnON, ZnSnO, CdSnO, GaSnO, TiSnO, CuBO2, CuAlO2, CuGaO2, SrCuO, LaCuOS, GaN, InGaN, AlGaN and InGaAlN.

19. The method of claim 16, wherein the metal containing layer has a higher mobility after the thermal treating.

20. A method for densifying a metal containing layer disposed on a substrate comprising:

forming a metal containing layer on a substrate;

implanting dopants into the metal containing layer; and

thermally treating the metal containing layer on the substrate at a pressure between 2 bar and 50 bar while maintaining a substrate temperature less than 500 degrees Celsius.