CLAIMS

1. A method of protecting an exposed layer of a semiconductor substrate comprising:

a) providing a solution forming a co-polymer having a ceiling temperature;

b) dispensing the solution onto ~~a surface of a~~the substrate to form a sacrificial protective layer that covers the exposed layer to form a protected layer,

wherein the co-polymer is kinetically trapped to allow storage at a temperature above the ceiling temperature;

c) exposing the substrate to ambient conditions for a predetermined period, wherein the sacrificial protective layer protects the protected layer from exposure to the ambient conditions; and

d) exposing the sacrificial protective layer to a stimulus to de-polymerize the sacrificial protective layer, thereby exposing the protected layer to form an exposed layer and allowing further processing of the exposed layer.

2. The method of claim 1, wherein exposing the substrate to ambient conditions comprises exposing the substrate to fluorine.

3. The method of claim 1, wherein exposing the substrate to ambient conditions comprises exposing the substrate to oxygen and water.

4. The method of claim 1, further comprising performing further processing of the exposed layer after (d).

~~2~~5. The method of claim 1, wherein the co-polymer comprises a poly(aldehyde) co-polymer.

~~3~~6. The method of claim 1, wherein the ceiling temperature is lower than room temperature.

~~4~~7. The method of claim 1, further comprising dispensing a casting solvent on the substrate prior to dispensing the solution on the substrate.

~~5~~8. The method of claim 1, further comprising adding a thermal catalyst to the solution prior to dispensing the solution.

~~6~~9. The method of claim ~~5~~8, wherein the thermal catalyst comprises a thermal acid generator or a thermal base generator.

~~7~~10. The method of claim 1, further comprising adding a photocatalyst to the solution prior to dispensing the solution.

~~8~~11. The method of claim ~~7~~10, wherein the photocatalyst comprises a photo acid generator or a photo base generator.

~~9~~12. The method of claim ~~7~~10, further comprising adding a dye to the photocatalyst.

~~10~~13. The method of claim 1, wherein d) includes:

d1) dispensing a thermal catalyst onto the sacrificial protective layer; and

d2) heating the substrate to a temperature that is greater than a catalyzed co-polymer degradation temperature and less than an un-catalyzed co-polymer temperature.

~~11~~14. The method of claim ~~10~~13, further comprising repeating d1) and d2) one or more times until the sacrificial protective layer is removed.

~~12~~15. The method of claim ~~10~~13, further comprising d3) heating the substrate to a temperature that is greater than the un-catalyzed co-polymer temperature to remove remaining portions of the sacrificial protective layer.

~~13~~16. The method of claim ~~10~~13, wherein the thermal catalyst comprises a thermal acid generator or a thermal base generator.

~~14~~17. The method of claim 1, further comprising:

prior to b), performing a first treatment process on the substrate in a first substrate processing tool;

performing a) and b) in the first substrate processing tool;

performing d) in a second substrate processing tool; and

performing a second treatment process on the substrate in the second substrate processing tool.

~~15~~18. The method of claim ~~14~~17, wherein:

the first treatment process comprises deposition, etching, stripping, cleaning, chemical mechanical planarization (CMP), patterning, or modification of electrical properties of the substrate; and

the second treatment process comprises deposition, etching, stripping, cleaning, chemical mechanical planarization (CMP), patterning, or modification of electrical properties of the substrate.

~~16~~19. The method of claim 1, wherein the stimulus comprises heat.

~~17~~20. The method of claim 1, wherein the stimulus comprises UV radiation.

~~18~~21. The method of claim 1, wherein the stimulus comprises acidic vapor.

~~19~~22. A method comprising:

a) providing a semiconductor substrate having sensitive surface; ~~and~~

b) dispensing a solution comprising a polymer having a ceiling temperature onto the sensitive surface of the substrate to form a sacrificial protective layer, wherein the polymer is kinetically trapped to allow storage at a temperature above the ceiling temperature, and

c) exposing the semiconductor substrate to ambient conditions, wherein the sacrificial protective layer protects the sensitive surface from exposure to the ambient conditions.

23. The method of claim 22, wherein the sensitive surface comprises silicon, silicon germanium, germanium, tungsten, or a combination thereof.

24. The method of claim 22, wherein the sensitive substrate comprises a fin.

~~20~~25. A method comprising:

receiving from storage a semiconductor substrate having a sensitive surface, the sensitive surface covered by a sacrificial protective layer comprising a polymer having a ceiling temperature, wherein the polymer is kinetically trapped to allow storage at a temperature above a ceiling temperature; and

exposing the sacrificial protective layer to a stimulus to de-polymerize and remove the sacrificial protective layer without damaging the sensitive surface thereby allowing further processing of the sensitive surface.

~~21~~26. A processing chamber comprising:

a) a substrate support for supporting a semiconductor substrate having a sensitive surface;

b) a fluid delivery system for delivering a solution comprising a polymer having a ceiling temperature onto the sensitive surface of the substrate; and

c) a controller comprising instructions for: (i) delivering ~~a~~the solution ~~comprising a polymer having a ceiling temperature~~ onto the sensitive surface of the substrate to form a sacrificial protective layer, wherein the polymer is kinetically trapped to allow storage at a temperature above the ceiling temperature; and (ii) exposing the semiconductor substrate to ambient conditions, wherein the sacrificial protective layer protects the sensitive surface from exposure to the ambient conditions.

~~22~~27. A processing chamber comprising:

a) a substrate support for supporting a semiconductor substrate having a sensitive surface;

b) one or both of a source of heat and a UV source for exposing a sacrificial protective layer on the sensitive surface to heat and/or UV radiation; and

c) a controller comprising instructions for:

i) receiving from storage the semiconductor substrate having a sensitive surface, the sensitive surface covered by a sacrificial protective layer comprising a polymer having a ceiling temperature, wherein the polymer is kinetically trapped to allow storage at a temperature above a ceiling temperature; and

ii) exposing the sacrificial protective layer to heat and/or UV radiation to de-polymerize and remove the sacrificial protective layer without damaging the sensitive surface.