CLAIMS

~~What is claimed is:~~

1. An apparatus for delamination drying a substrate, comprising:

a chamber for receiving a substrate;

a chuck for supporting and clamping the substrate within the chamber;

a temperature controller for controlling the temperature of the substrate, which is able to cool the substrate;

a vacuum pump in fluid connection with the chamber; and

a tilting mechanism that is able to tilt the chuck at least 90 degrees, wherein the chuck has a first position providing a horizontal surface and a second position, wherein the titling mechanism tilts the horizontal surface to become a vertical surface and tilts the vertical surface to become a horizontal surface; and

a solid drying chemistry removal system place below the chuck.

2. The apparatus, as recited in claim 1, further comprising an atmosphere control system in fluid connection with the chamber for flowing a controlled atmosphere into the chamber.

3. The apparatus, as recited in claim 2, wherein the atmosphere control comprises a gas source for providing a dry gas into the chamber.

4. The apparatus, as recited in ~~any of~~ claim~~s 1-3~~ 2, wherein the chuck is an electrostatic chuck.

5. The apparatus, as recited in ~~any of~~ claim~~s 1-~~ 4, further comprising a voltage source for providing a voltage for clamping the substrate to the electrostatic chuck.

6. The apparatus, as recited in ~~any of~~ claim~~s 1-5~~ 4, further comprising a wet transfer station for transferring a substrate with a wet drying chemistry into the chamber and sealing the chamber, wherein the temperature controller is able to cool the substrate to a temperature that freezes the drying chemistry.

7. The apparatus, as recited in ~~any of~~ claim~~s~~ 1~~-6~~, wherein the chuck comprises grooves.

8. The apparatus, as recited in ~~any of~~ claim~~s~~ 1~~-7~~, wherein the temperature controller comprises temperature control elements embedded within the chuck.

9. The apparatus, as recited in claim 8, wherein the temperature control elements are able to cool the substrate down to a temperature of at least 0° C and heat the substrate up to a temperature of at least 20° C.

~~10. The apparatus, as recited in any of claims 1-9, wherein the temperature control elements comprise thermoelectric heating and cooling elements embedded within the chuck.~~

~~11.~~10. A method, comprising:

placing a substrate, which is wet with a drying chemistry, on a chuck in a drying chamber;

freezing the drying chemistry to a solid drying chemistry on the substrate;

delaminating the solid drying chemistry from the substrate; and

removing the delaminated solid drying chemistry from the substrate.

~~12.~~11. The method, as recited in claim ~~11~~ 10, wherein the delaminating the solid drying chemistry from the substrate, comprises reducing the pressure in the chamber.

~~13.~~12. The method, as recited in ~~any of~~ claim~~s~~ 11~~-12~~, wherein the freezing the drying chemistry, comprises:

chucking the substrate to the chuck; and

using the chuck to back side cool the substrate below the freezing point of the drying chemistry to freeze the drying chemistry.

~~14.~~13. The method, as recited in ~~any of~~ claim~~s 11-13~~ 10, wherein the removing the solid drying chemistry from the substrate, comprises tilting the substrate at least 90°.

~~15.~~14. The method, as recited in ~~any of~~ claim~~s 11-14~~ 13, further comprising:

forming features on the substrate; and

wet treating the features on the substrate.

~~16.~~15. The method, as recited in ~~any of~~ claim~~s 11-15~~ 14, wherein the drying chemistry comprises *tert*-butanol.

~~17.~~16. The method, as recited in ~~any of~~ claim~~s 11-16~~ 10, further comprising removing moisture from an atmosphere in the chamber.

~~18.~~17. The method, as recited in ~~any of~~ claim~~s 11-17~~ 10, further comprising heating the chuck to a temperature above the freezing point of the drying chemistry before placing the substrate on the chuck.

~~19.~~18. The method, as recited in ~~any of~~ claim~~s 11-18~~ 10, further comprising catching liquid drying chemistry that flows from the substrate on the chuck and directing the liquid drying chemistry from points of contact between the substrate and the chuck.

19. The apparatus, as recited in claim 1, wherein the tilting mechanism tilts the chuck with respect to the chamber.