1. A method for removing material from a semiconductor wafer, comprising:

maintaining a pressure within a volume within which a semiconductor wafer resides to be sufficient to maintain a precursor fluid to a non-Newtonian fluid in a liquid state, wherein the precursor fluid is a liquid having a propellant material in a liquid state, and wherein the precursor fluid includes one or more hydrotropes for controlling a size of micelles within the non-Newtonian fluid, wherein the one or more hydrotropes bind to surfaces of the micelles, and wherein the non-Newtonian fluid has a viscosity that changes with an applied shear force;

~~disposing~~ applying the precursor fluid on the semiconductor wafer while maintaining the precursor fluid and propellant material therein in the liquid state, wherein the precursor fluid is disposed proximate to a photoresist crust material to be removed from the semiconductor wafer;

allowing the precursor fluid to penetrate through the photoresist crust material to reach vacant regions that underlie the photoresist crust material; and

reducing the pressure in the volume to cause the propellant material in the precursor fluid to transform from the liquid state into a gaseous state so as to cause the precursor fluid to transform into the non-Newtonian fluid, whereby an expansion of the precursor fluid during the transformation causes the non-Newtonian fluid to apply mechanical force to the photoresist crust material from within the vacant regions that underlie the photoresist crust material so as to remove the photoresist crust material from the semiconductor wafer.

2. A method for removing material from a semiconductor wafer as recited in claim 1, wherein expansion of the precursor fluid into the non-Newtonian fluid also

applies mechanical force to remove a polymer material from the semiconductor wafer ~~the material to be removed from the semiconductor wafer by the non-Newtonian fluid is one of photoresist crust, polymer material, and both photoresist crust and polymer material~~.

3. A method for removing material from a semiconductor wafer as recited in claim ~~2~~1, further comprising:

removing a bulk photoresist portion using a wet chemistry prior to disposing the precursor fluid on the semiconductor wafer, the removing being performed after an etch operation and such removing of the bulk photoresist portion being performed to leave the photoresist crust material, wherein the photoresist crust material is created during the etch operation.

4. A method for removing material from a semiconductor wafer as recited in claim 1, wherein the precursor fluid is ~~a liquid having propellant in a liquid state included therein, the precursor fluid~~ capable of being disposed within vias and between high aspect ratio features on the semiconductor wafer, the precursor fluid capable of penetrating through ~~a~~ the photoresist crust material to a region underlying the photoresist crust material.

5. A method for removing material from a semiconductor wafer as recited in claim ~~4~~1, wherein an amount of propellant material included in the precursor fluid is within a range extending from about 5% by weight to about 20% by weight of the precursor fluid following inclusion of the propellant material.

6. A method for removing material from a semiconductor wafer as recited in claim 1, wherein the precursor fluid is defined to include surfactants and additives capable of stabilizing bubbles that form during transformation of the precursor fluid into the non-Newtonian fluid.

~~7. A method for removing material from a semiconductor wafer as recited in claim 1, wherein reducing the pressure in the volume causes expansion of a propellant dissolved in the precursor fluid, expansion of the propellant causing the precursor fluid to transform into the non-Newtonian fluid.~~

~~8~~7. A method for removing material from a semiconductor wafer as recited in claim ~~7~~1, wherein a volume of the non-Newtonian fluid ~~following expansion of the propellant~~ is within a range extending from about 2 times to about 100 times the volume of the precursor fluid in the liquid state.

~~9~~8. A method for removing material from a semiconductor wafer as recited in claim 1, further comprising:

controlling a temperature to control the expansion of the precursor fluid during the transformation from the liquid state into the non-Newtonian fluid.

~~10~~9. A method for removing material from a semiconductor wafer as recited in claim 1, wherein the pressure sufficient to maintain the precursor fluid and propellant material ~~to the non-Newtonian fluid~~ in the liquid state is greater than 1 atmosphere (atm).

~~11~~10. A method for removing material from a semiconductor wafer as recited in claim 1, wherein the pressure sufficient to maintain the precursor fluid and propellant material ~~to the non-Newtonian fluid~~ in the liquid state is less than or equal to 1 atmosphere (atm).

~~12~~11. A method for removing photoresist and polymer material from a semiconductor wafer, comprising:

disposing a solution on a semiconductor wafer to remove a bulk photoresist material, wherein the solution penetrates through a photoresist material to remove the bulk photoresist material while leaving a photoresist crust;

following removal of the bulk photoresist material, ~~disposing~~ applying a precursor fluid to a non-Newtonian fluid on the semiconductor wafer, wherein the precursor fluid is a liquid having a propellant material in a liquid state, and wherein the precursor fluid includes one or more hydrotropes for controlling a size of micelles within the non-Newtonian fluid, wherein the one or more hydrotropes bind to surfaces of the micelles, and wherein the non-Newtonian fluid is a fluid having a viscosity that changes with an applied shear force, the precursor fluid and propellant material therein being maintained in ~~a~~ the liquid state when disposed on the semiconductor wafer, the precursor fluid being disposed to penetrate through the photoresist crust to vacant regions underlying the photoresist crust and to be proximate to a polymer material present on the semiconductor wafer; and

reducing a pressure ambient to the semiconductor wafer to cause the propellant material in the precursor fluid to transform from the liquid state into a gaseous state so as to cause the precursor fluid to transform ~~the precursor fluid~~ into the non-Newtonian fluid,

whereby an expansion of the precursor fluid during the transformation causes the non-Newtonian fluid to apply mechanical force to the photoresist crust and polymer materials so as to remove the photoresist crust and polymer ~~material~~ materials from the semiconductor wafer.

~~13. A method for removing photoresist and polymer material from a semiconductor wafer as recited in claim 12, wherein removal of the photoresist crust and polymer material by the non-Newtonian fluid is a result of mechanical force exerted by the non-Newtonian fluid on the photoresist crust and polymer material.~~

~~14~~12. A method for removing photoresist and polymer material from a semiconductor wafer as recited in claim ~~12~~11, wherein photoresist crust and polymer material removed by the non-Newtonian fluid is entrained in the non-Newtonian fluid such that the removed photoresist crust and polymer material does not resettle on the semiconductor wafer.

~~15~~13. A method for removing photoresist and polymer material from a semiconductor wafer as recited in claim ~~12~~11, wherein reducing the pressure ambient to the semiconductor wafer is performed such that the precursor fluid in the liquid state is transformed into the non-Newtonian fluid within a duration extending from about 0.01 second to about 2 seconds.

~~16~~14. A method for removing photoresist and polymer material from a semiconductor wafer as recited in claim ~~12~~11, wherein the precursor fluid includes an amount of the solution used to remove the bulk photoresist material.

~~17. A method for removing photoresist and polymer material from a semiconductor wafer as recited in claim 12, wherein reducing the pressure ambient to the semiconductor wafer causes expansion of a propellant included in the precursor fluid, expansion of the propellant causing the precursor fluid in the liquid state to transform into the non-Newtonian fluid.~~

~~18~~15. A method for removing photoresist and polymer material from a semiconductor wafer as recited in claim ~~17~~11, wherein a volume of the non-Newtonian fluid ~~following expansion of the propellant~~ is within a range extending from about 2 times to about 100 times the volume of the precursor fluid in the liquid state.

16. A method for removing material from a semiconductor wafer as recited in claim 1, wherein the one or more fatty acids included within the precursor fluid serve to stabilize bubbles that form during transformation of the precursor fluid into the non-Newtonian fluid.

17. A method for removing material from a semiconductor wafer as recited in claim 1, wherein the precursor fluid includes one or more fatty acids.

18. A method for removing material from a semiconductor wafer as recited in claim 1, wherein the precursor fluid includes wet photoresist stripping chemicals.

19. A method for removing material from a semiconductor wafer as recited in claim 1, wherein the precursor fluid includes cellulose to stabilize bubbles that form during transformation of the precursor fluid into the non-Newtonian fluid.

20. A method for removing material from a semiconductor wafer as recited in claim 1, wherein the precursor fluid includes an oil to stabilize bubbles that form during transformation of the precursor fluid into the non-Newtonian fluid.

21. A method for removing material from a semiconductor wafer as recited in claim 1, wherein the precursor fluid includes a protein to stabilize bubbles that form during transformation of the precursor fluid into the non-Newtonian fluid.

22. A method for removing material from a semiconductor wafer as recited in claim 1, whereby the expansion of the precursor fluid during the transformation causes the non-Newtonian fluid to exert a uniform hydrostatic pressure on each side of features present on the semiconductor wafer so as not to damage the features.

23. A method for removing photoresist and polymer material from a semiconductor wafer as recited in claim 11, wherein the precursor fluid includes one or more fatty acids.

~~19. An apparatus for removing material from a semiconductor wafer, comprising:~~

~~a chamber;~~

~~a fluid input connected to the chamber and configured to dispose a precursor fluid to a non-Newtonian fluid on a semiconductor wafer to be supported within the chamber;~~

~~a pressurization device configured to control a pressure within the chamber to maintain the precursor fluid in a liquid state when being disposed on the semiconductor wafer; and~~

~~a pressure release device configured to release a pressure within the chamber to a lower pressure environment, wherein the release of the pressure within the chamber is sufficient to cause the precursor fluid to transform from the liquid state into the non-Newtonian fluid, whereby an expansion of the precursor fluid during the transformation is sufficient to cause the non-Newtonian fluid to remove material from the semiconductor wafer.~~

~~20. An apparatus for removing material from a semiconductor wafer as recited in claim 19, further comprising:~~

~~a temperature control configured to control a temperature within the chamber, wherein control of the temperature within the chamber enables control of the expansion of the precursor fluid during the transformation from the liquid state into the non-Newtonian fluid.~~

~~21. An apparatus for removing material from a semiconductor wafer as recited in claim 19, wherein the pressure release device is configured to release the pressure within~~

~~the chamber to the lower pressure environment such that the precursor fluid is transformed from the liquid state into the non-Newtonian fluid within a duration extending from about 0.01 second to about 2 seconds.~~

~~22. An apparatus for removing material from a semiconductor wafer as recited in claim 19, wherein the chamber is further defined to conduct a wet stripping operation on the semiconductor wafer prior to disposing the precursor fluid on the semiconductor wafer, the wet stripping operation serving to remove a bulk portion of photoresist material from the semiconductor wafer while leaving a photoresist crust on the semiconductor wafer.~~

~~23. An apparatus for removing material from a semiconductor wafer as recited in claim 19, wherein the precursor fluid is a liquid having propellant included therein.~~

~~24. An apparatus for removing material from a semiconductor wafer as recited in claim 19, wherein the material removed from the semiconductor wafer is one of photoresist crust, polymer material, and both photoresist crust and polymer material.~~