What is claimed is:

1. A method for delivering supercritical and non-supercritical phases of carbon dioxide to create a customized cleaning sequence for the removal of contaminants from a surface of a substrate, comprising the steps of:

introducing a solvent fluid comprising carbon dioxide in a supercritical phase into a chamber containing the substrate, wherein the supercritical phase is mixed with co-solvent additives;

transferring contaminants from the substrate surface into the supercritical carbon dioxide phase to form at least a partially spent supercritical phase of carbon dioxide;

removing the at least partially spent supercritical carbon dioxide phase from the chamber and simultaneously introducing fresh carbon dioxide in the supercritical phase into the chamber so as to dilute the spent supercritical carbon dioxide and substantially inhibit the contaminants from precipitating onto the substrate surface, wherein the fresh carbon dioxide optionally includes additional co-solvents dissolved therein;

subsequently introducing carbon dioxide in a liquid phase into a chamber; and

flowing the carbon dioxide liquid phase over the substrate surface to flush and rinse the substrate surface and thereby remove the contaminants, and the co-solvents and the additional co-solvents that may have remained on the substrate surface after the cleaning sequence.

2. The method of claim 1, wherein the dilution step occurs at constant pressure.

3. The method of claim 1, wherein the dilution step occurs while simultaneously venting the chamber so as to depressurize the chamber to a pressure greater than atmospheric pressure.

4. The method of claim 1, further comprising venting to atmospheric pressure

after the flushing and rinsing with the carbon dioxide liquid phase.

5. The method of claim 1, further comprising introducing a second solvent or additive.

6. The method of claim 1, further comprising pressurizing the chamber to a predetermined working pressure prior to introducing the solvent fluid.

7. The method of claim 6, wherein pure gas phase carbon dioxide is introduced to pressurize the chamber.

8. The method of claim 1, wherein successive dilutions are employed.

9. A method for delivering different phases of carbon dioxide to create a customized cleaning sequence for the removal of contaminants from a surface of a substrate, comprising the steps of:

introducing pure gas phase carbon dioxide to pressurize the chamber to a first pressure below a saturated vapor pressure;

removing the pure gas phase and subsequently introducing carbon dioxide in a supercritical phase to increase the chamber pressure from the first pressure to a second pressure higher than the first pressure;

introducing a solvent fluid at the second pressure comprising carbon dioxide in a supercritical phase mixed with co-solvents into a chamber containing the substrate;

transferring contaminants from the substrate surface into the supercritical carbon dioxide phase to form at least a partially spent supercritical phase of carbon dioxide;

removing the at least partially spent supercritical carbon dioxide phase from the chamber and simultaneously introducing fresh carbon dioxide in the supercritical phase without the co-solvents into the chamber so as to dilute the spent supercritical carbon dioxide and substantially inhibit the contaminants from

precipitating onto the substrate surface;

subsequently introducing carbon dioxide in a liquid phase into a chamber; and

flowing the carbon dioxide liquid phase over the substrate surface to flush and rinse the substrate surface and thereby remove the contaminants and any co-solvents residually remaining on the substrate surface.

10. The method of claim 9, wherein the step of introducing the pure phase carbon dioxide is performed using a cycle pulse purge, whereby air is being displaced with the pure phase carbon dioxide.

11. The method of claim 10, wherein the cycle pulse purge comprises a plurality of pulse purges, wherein each pulse purge incrementally increases the chamber pressure.

12. The method of claim 11, wherein the displaced air is vented.

13. The method of claim 9, wherein the first pressure is between about A to about B. [probably close to process pressure since condensation is minimal and first pressurization step quicker than second pressurization step]

14. The method of claim 9, wherein a rate for attaining the first pressure is greater than a rate for attaining the second pressure.

15. A supply system for purifying and delivering multiple phases of carbon dioxide to a downstream process chamber, comprising:

a first accumulator positioned between a purification unit and the chamber, the first accumulator comprising saturated liquid phase carbon dioxide and saturated vapor phase carbon dioxide;

a second accumulator positioned between the purification unit and the chamber, the second accumulator comprising supercritical phase carbon dioxide;

a purification unit positioned upstream of the first and the second accumulators to produce purified carbon dioxide from a bulk tank containing crude carbon dioxide; and

a flow network positioned at the outlet of the first and the second accumulators and having a first leg, a second leg, a third leg, a first control valve a second control valve and a third control valve.

16. The supply system of claim 15, wherein each of the accumulators comprise heaters to achieve set point pressures.

17. The supply system of claim 16, wherein the first accumulator has a temperature maintained between 21C-30C and the second accumulator has a temperature greater than 31C.

18. The supply system of claim 15, wherein the flow network is configured to deliver liquid, vapor and supercritical phase carbon dioxide to two or more chambers.

19. The supply system of claim 15, wherein the second accumulator is a bellows chamber.

20. A method for preventing contaminants from precipitating onto a substrate surface during cleaning of the substrate, comprising the steps of:

pressurizing the process chamber to a first pressure, wherein the first pressure is at least equal to about a supercritical pressure of carbon dioxide; and

supplying supercritical carbon dioxide into the process chamber, wherein the supercritical carbon dioxide is delivered to the chamber at a second pressure greater than the first pressure.

21. The method of claim 20, wherein the step of supplying supercritical carbon dioxide comprises configuring and modulating a bellows chamber to compress the

supercritical carbon dioxide to the second pressure.

22. The method of claim 20, wherein the step of pressurizing the process chamber to a first pressure comprises pressurizing the process chamber with air or an inert gas prior to supplying the supercritical carbon dioxide into the process chamber.

23. The method of claim 22, wherein the supercritical carbon dioxide displaces the air or inert gas.

24. The method of claim 20, wherein pressures losses incurred by the supercritical carbon dioxide during the supply to the chamber remains insufficient so as to not cause the supercritical carbon dioxide to reduce to a subcritical carbon dioxide phase.

What is claimed is:

1. A method for delivering different phases of carbon dioxide to create a customized cleaning sequence for the removal of contaminants from a surface of a substrate, comprising the steps of:

introducing pure gas phase carbon dioxide to pressurize the chamber to a first pressure below a saturated vapor pressure;

removing the pure gas phase and subsequently introducing carbon dioxide in a supercritical phase to increase the chamber pressure from the first pressure to a second pressure higher than the first pressure;

introducing a solvent fluid at the second pressure comprising carbon dioxide in a supercritical phase mixed with co-solvents into a chamber containing the substrate;

transferring contaminants from the substrate surface into the supercritical carbon dioxide phase to form at least a partially spent supercritical phase of carbon dioxide;

removing the at least partially spent supercritical carbon dioxide phase from the chamber and simultaneously introducing fresh carbon dioxide in the supercritical phase without the co-solvents into the chamber so as to dilute the spent supercritical carbon dioxide and substantially inhibit the contaminants from precipitating onto the substrate surface;

subsequently introducing carbon dioxide in a liquid phase into a chamber; and

flowing the carbon dioxide liquid phase over the substrate surface to flush

and rinse the substrate surface and thereby remove the contaminants and any co-solvents residually remaining on the substrate surface, wherein the first pressure is between about A to about B. [probably close to process pressure since condensation is minimal and first pressurization step quicker than second pressurization step]