CLAIMS

What is claimed is:

1. A method for cleaning a surface, having particulate matter interspersed thereon, of a substrate, said method comprising:

impinging ~~upon said surface~~ a liquid having coupling elements and immiscible gas components entrained therein upon said surface, said impinging being configured to scan the liquid over and across an entire area of the surface of the substrate, said coupling elements being deformable non-crystalline solids and said substrate being a wafer, wherein the immiscible gas components comprise 50% to 95%, inclusive, of the liquid by weight; and

imparting sufficient drag upon said coupling elements to move within said liquid and impart a quantity of said drag upon said particulate matter, with said quantity being of sufficient magnitude to cause said particulate matter to move with respect to said substrate.

2. The method as recited in claim 1 wherein imparting further includes providing said coupling elements and said liquid with relative momentum to facilitate said coupling elements contacting said particulate matter and cause said particulate matter to move with respect to said substrate, wherein a hardness of said coupling elements is less than a hardness of said surface.

~~3. The method as recited in claim 1 wherein imparting further includes scanning a jet of said liquid across said surface.~~

3~~4~~. The method as recited in claim 1 wherein imparting further includes scanning a jet to have said liquid impact said surface at different angles measured from a normal to said surface.

4~~5~~. The method as recited in claim 1 wherein imparting further includes scanning a jet along a first direction to have said liquid impact upon said surface at different angles measured from a normal to said surface while generating relative

movement between said jet and said surface along a plane that extends transversely to said jet.

5~~6~~. The method as recited in claim 1 wherein impinging further includes directing a jet along a path to have said liquid impact upon said surface while generating different angles between said path and a normal to said surface, said normal lying in a plane extending orthogonally from said surface, with said path being positioned at different angles with respect to said plane.

6~~7~~. The method as recited in claim 1 further including generating a foam of said liquid upon said surface.

7~~8~~. The method as recited in claim 1 wherein impinging further includes ~~direction~~ directing a jet of said ~~fluid~~ liquid upon said surface and further including terminating said jet and generating foam from said liquid upon said surface.

8~~9~~. The method as recited in claim 1 wherein impinging further includes ~~direction~~ directing a jet of said ~~fluid~~ liquid upon said surface and further including terminating said jet and generating a foam of said liquid upon said surface and exposing said foam to a fluid to remove the foam from the surface and exposing said fluid to a vacuum to remove a quantity of the same.

9~~10~~. A method for cleaning a surface, having particulate matter thereon, of a substrate, said method comprising:

scanning a jet of a liquid, having coupling elements and immiscible gas components entrained therein over and across an entire area of the surface of the substrate, the scanning occurring along a first direction to impinge upon said surface at different angles measured from a normal to said surface while generating relative movement between said jet and said surface along a plane that extends transversely to said normal to impart sufficient drag upon said coupling elements to move within said liquid and impart a quantity of said drag upon said particulate matter, with said quantity being of sufficient

magnitude to cause said particulate matter to move with respect to said substrate, wherein the immiscible gas components comprise 50% to 95%, inclusive, of the liquid by weight;

wherein said coupling elements are deformable non-crystalline solids that at least partially conform to some of the particulate matter to assist in the cleaning of the particulate matter off of said surface and said substrate being a wafer.

10~~11~~. The method as recited in claim ~~1~~ 9 wherein said normal lies in a plane extending orthogonally from said surface and scanning further includes directing ~~positioning~~ said ~~path~~ jet at different angles with respect to said plane.

11~~12~~. The method as recited in claim ~~10~~ 9 further including generating a foam of said liquid upon said surface.

12~~13~~. The method as recited in claim ~~10~~ 9 further including terminating said jet and generating foam of said liquid upon said surface.

13~~14~~. The method as recited in claim ~~10~~ 9 further including terminating said jet and generating a foam of said liquid upon said surface and exposing said foam to a fluid to remove the foam from the surface and exposing said fluid to a vacuum to remove a quantity of the same.

~~15. A system having a processing region for cleaning particulate matter from a surface of a substrate, said system comprising:~~

~~a fluid delivery sub-system;~~

~~a carrier to support said substrate;~~

~~a jetting sub-system;~~

~~a processor in data communication with said fluid delivery sub-system, said carrier sub-system and said jetting sub-system; and~~

~~a memory in data communication with said processor, said memory storing computer-readable instructions to be operated on by said processor, said computer-readable instructions including code to control said fluid delivery sub-system and said jetting sub-system to impinge, upon said surface, a jet of a liquid having coupling elements entrained~~

~~therein with sufficient drag to cause said coupling elements to move within said liquid and impart a quantity of said drag upon said particulate matter to cause said particulate matter to move with respect to said substrate.~~

~~16. The system as recited in claim 15 further including a pump system and wherein said computer-readable instructions further includes code to control operation of said jetting sub-system to scan said jet of said liquid across said surface.~~

~~17. The system as recited in claim 15 wherein said computer-readable instructions further includes code to control operation of said jetting sub-system to scan said jet to impinge upon said surface at different angles measured from a normal to said surface.~~

~~18. The system as recited in claim 15 wherein said computer-readable instructions further includes code to control operation of said jetting sub-system and said carrier sub-system to scan said jet along a first direction to impinge upon said surface at different angles measured from a normal to said surface while generating relative movement between said jet and said surface along a plane that extends transversely to said jet.~~

~~19. The system as recited in claim 15 wherein said computer-readable instructions further includes code to control operation of said jetting sub-system to scan said jet along a first direction to impinge upon said surface at different angles measured from a normal to said surface while generating relative movement between said jet and said surface along a plane that extends transversely to said jet.~~

~~20. The system as recited in claim 15 wherein said computer-readable instructions further includes code to control operation of said jetting sub-system to direct said jet along a path to impinge upon said surface while generating different angles between said path and a normal to said surface, said normal lying in a plane extending orthogonally from said surface, code to control further including instruction to cause said jetting sub-system to vary an angle between said path and said plane.~~

14. A method for cleaning a surface, having particulate matter thereon, of a substrate, said method comprising:

impinging upon said surface liquid having coupling elements and immiscible gas components entrained therein by scanning a jet of said liquid over and across an entire area of said surface to impart sufficient drag upon said coupling elements to move within said liquid and impart a quantity of said drag upon said particulate matter, with said quantity being of sufficient magnitude to cause said particulate matter to move with respect to said substrate;

wherein said coupling elements include non-crystalline solids with a hardness less than a hardness of the surface of the substrate, that at least partially conform to some of the particulate matter to assist in the cleaning of the particulate matter off of said surface and said substrate being a wafer and wherein the immiscible gas components comprise 50% to 95%, inclusive, of the liquid by weight.

15. The method as recited in claim 14 wherein impinging further includes directing a jet of said liquid upon said surface and further including terminating said jet and generating a foam of said liquid upon said surface and exposing said foam to a fluid to remove the foam from the surface and exposing said fluid to a vacuum to remove a quantity of the same.

16. The method as recited in claim 14 wherein impinging further includes directing said jet along a path to have said liquid impact upon said surface while generating different angles between said path and a normal to said surface, said normal lying in a plane extending orthogonally from said surface, with said path being positioned at different angles with respect to said plane.

17. The method as recited in claim 14 wherein impinging further includes scanning said jet to have said liquid impact said surface at different angles measured from a normal to said surface.

18. The method as recited in claim 17 wherein impinging further includes terminating said jet and generating foam from said liquid upon said surface.

19. The method as recited in claim 18 wherein impinging further includes providing said coupling elements and said liquid with relative momentum to facilitate said coupling elements contacting said particulate matter and cause said particulate matter to move with respect to said substrate.