Single Wafer/Mask Cleaning Systems

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NANO-MASTER Single Wafer/Mask Cleaning Systems

Damage-Free Megasonic and Cleaning Technology

The latest developments in Megasonic and Cleaning Technology have opened up new horizons to achieve the cleanest wafers and masks used in MEMS and Semiconductor Industry.

NANO-MASTER offers Megasonic Single Wafer & Mask Cleaning (SWC) Systems and Large Substrate Cleaning (LSC) Systems for state of the art, damage-free megasonic cleaning of delicate patterned or unpatterned substrates including Pelliclized Masks. To achieve maximum cleaning optimization without substrate damage, the megasonic energy density must be kept slightly below the damage threshold at any point on the sample. NANO-MASTER's patented technology assures uniform distribution of the acoustic energy across the entire surface of the substrate allowing ideal cleaning by maximizing the distributed energy while staying below the sample's damage threshold.

The SWC and LSC systems provide controlled chemical dispensing capabilities. With this capability, the ability to remove particles from the surface is enhanced. The SWC and LSC utilize a Point-of-Use Chemical Dispense System designed for minimal use of chemistries. Utilizing the chemical dispense in conjunction with NANO-MASTER's megasonic cleaning technology, the tool's capability to remove particles is optimized. Afterwards, the released particles are removed from the substrate surface with the least number of reattachments by sweeping off the particles with the radial flow of the DI water. Without the advantage of radial DI water flow, stationary recirculation megasonic cleaning tanks allow a greater number of reattachments and therefore require additional time to remove these particles.

In addition, both NANO-MASTER cleaners offer an array of options. A PVA brush system provides a mechanical mean of removing stains and resist residues on unpatterned substrates. The ozonated DI water option allows removal of organics without the use of aggressive chemicals. Depending on the application, certain options will further enhance the tool's ability to remove unwanted particles and residues.

Both SWC and LSC tools are capable to do in-situ spin drying with heated N2 or IPA. "Dry-In-Dry-Out" one step processing is possible with the lowest capital investment and Cost of Ownership. The process time for NANO-MASTER's cleaners can vary between 3-5 minutes per substrate depending in the substrate's size and additional cleaning options used.

NANO-MASTER's technology is also applicable to cleaning the backside of masks, or the alignment marks on the front side of Pelliclized Masks, reducing the need for unnecessary removal and re-pelliclization of these masks. It can also be used for removal of the pellicle frame-mounting adhesive and can prepare the surface for re-pelliclization. In addition, megasonic cleaning and spin drying of the full front surface of the pelliclized mask is conducted without damage and seepage condensation on the pellicle.

The SWC is the ideal tool with a small footprint and can be easily installed in any clean room where space is limited. The LSC's architecture is developed to deliver the most advanced capabilities for current and next generation wafer and substrate sizes. Both units deliver superior cleaning ability for a variety of substrates.

NANO-MASTER Single Wafer/Mask Cleaning Systems

Single Wafer/Mask Cleaner Model # SWC-3000 and SWC-4000

SWC-4000

SWC-3000

APPLICATIONS
- Patterned and Un-patterned Masks and Wafers
- Ge, GaAs and InP Wafer Cleaning
- Post CMP Wafer Cleaning
- Cleaning of Diced Chips on Wafer Frame
- Cleaning after Plasma Etch or Photoresist Stripping
- Mask Blanks or Contact Mask Cleaning
- Cleaning of X-ray and EUV Masks
- Optical Lens Cleaning
- Cleaning of ITO Coated Display Panels
- Megasonic Assisted Lift-off Process

SWC-3000 FEATURES
- 12” OD, 7” x 7” Substrates
- Table-Top Unit
- Venturi Powered Vacuum
- Damage Free Megasonic
- Independent Chemical Dispenses
- Spin Dry and Heated N_2
- Microprocessor Controlled
- Chemical Dispense Unit
- Safery Interlocks
- 19”D x 26”W Footprint

SWC-3000 OPTIONS
- PVA Brush Cleaning (100 RPM)
- Post CMP Brush (up to 400 RPM)
- Nitogen Ionizer
- CO_2 Inject with DIW Resistivity Monitor
- FM 4910 Materials

SWC-4000 FEATURES
- Everyting on the SWC-3000
- Stand Alone Unit
- Dual Drain for Acids and Solvents
- Suck Back Valves to Prevent Drips

SWC-4000 OPTIONS
- Everything on the SWC-3000
- Botton Side DIW and Dry
- In-Line Heaters for DIW or Chemical
- Fill Sensors for Chemical

NANO-MASTER Single Wafer/Mask Cleaning Systems

Large Substrate Cleaner Model # LSC-4000

LSC-4000

APPLICATIONS
- Si Wafers
- Saphire Wafers
- Chips on Wafer Frame
- Display Panels
- ITO Coated Displays
- Patterned and Un-patterned Masks
- Mask Blanks
- Pelliclized Reticles
- Contact Masks

FEATURES
- 21” OD, 15”x15” Substrates
- Supports 450 mm Wafer
- Damage Free Megasonic
- Variable Speed PVA Brush
- Chemical Dispenses with Suck Back Valves
- Spin Dry with Heated N2
- Dual Drain for Acids and Solvents
- PC Controlled with LabVIEW Software
- Touchscreen User Interface
- Manual Load and Unload
- Safety Interlocks and Alarm
- 32”D x 28”W Footprint

LSC-4000 Chamber

OPTIONS
- Pelliclized Reticle Cleaning
- Chemical Delivery Module
- Fill Sensors for Chemical Bottles
- Piranha Cleaning
- Ozonated DI Water (20 ppm of O3)
- High Pressure DI Water
- Heated DI Water
- Nitrogen Ionizer
- CO_2 Injector with DIW Resistivity Monitor
- FM4910 Materials
- Robotic Loading/Unloading with EFEM and SMIF Interface

NANO-MASTER Single Wafer/Mask Cleaning Systems

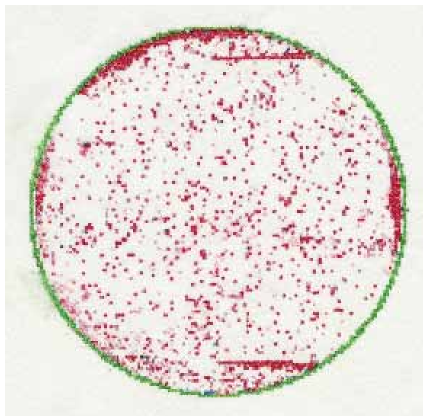
NANO-MASTER's Response to Challenges in Cleaning

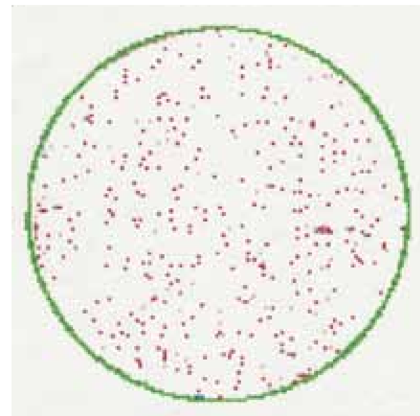
Cleaning Issues	Solutions
Damage	Patented Uniform Megasonic Energy Deposition
Delicate Substrates	Megasonic Cleaning, Vacuum Chuck
Particle Size	Megasonic Frequency
Particle Reattachment	Spin Processing
Organic Contaminants	Ozonated DI water, Piranha Clean
Inorganic Contaminants	Chemical dispense, pH Control
Metal Contamination	SC1, SC2 Cleans
Back Surface Defectivity	Back Surface Clean with 1 mm Edge Contact
Re-Contamination	Single Step Process: Dry In Dry Out
Passivation	In-situ

CMP Wafer Cleaning with Brush

Mask Cleaning with Megasonic

SWC GERMANIUM WAFER CLEANING

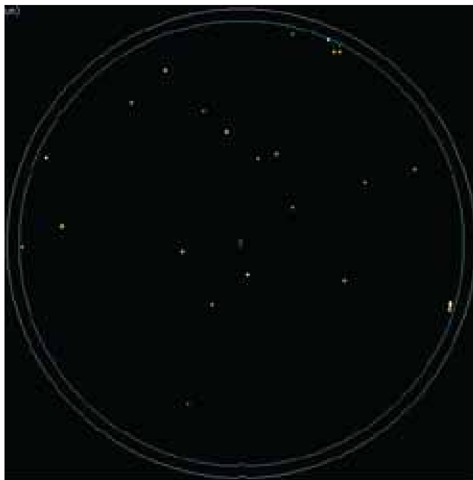




The pictures above were taken from the surface of two Germanium wafers that were polished and cleaned in parallel to compare the standard tank wafer cleaning (left) with Nano-Master SWC megasonic cleaning with DI water (right). The standard cleaning produced non uniform cleaning and caused damage from spin drying (the cassette stress marks are evident). In other application such as ceramic substrates, AlTiC wafers and ITO cleaning, customer expectations were exceeded and yield improvements were experienced.

SWC-4000 CMP CLEANING RESULTS

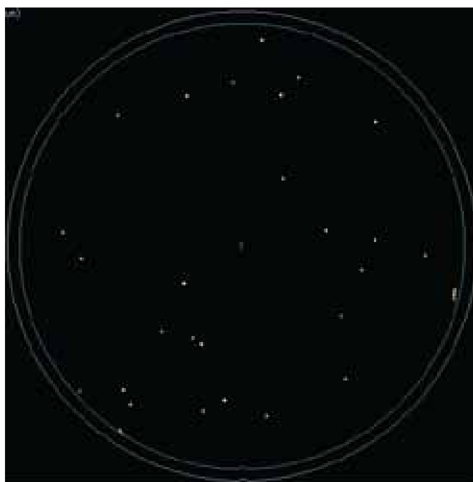
The first picture above was taken from the surface of a silicon wafer after the polisher. Half of the wafer was scanned becaused the surface scanner stops after the maximum total particle count was reached. The second picture is after cleaning the wafer with the SWC system (4 passes with the megasonic arm), total process time including drying was 90 seconds. No chemicals were used.



1	0.250 -	0.315:	9
2	0.315 -	0.396:	15
3	0.396 -	0.499:	2
4	0.499 -	0.629:	2
5	0.629 -	0.792:	1
6	0.792 -	0.997:	2
7	0.997 -	1.256:	1
8	1.256 -	1.581:	1
9	1.581 -	1.991:	0
10	1.991 -	2.507:	0
11	2.507 -	3.158:	0
12	3.158 -	3.976:	0
13	3.976 -	5.007:	0
14	5.007 -	6.306:	0
15	6.306 -	7.941:	0
16	7.941 -	10.000:	0
	Mean:		0.446
	Std. Dev.:		0.265

200 mm Tantalum
1.5PSI 89/78 RPM DaNano 125ml/min

Total defect > 0.25 μ = 33



1	0.250 -	0.315:	11
2	0.315 -	0.396:	12
3	0.396 -	0.499:	2
4	0.499 -	0.629:	0
5	0.629 -	0.792:	1
6	0.792 -	0.997:	2
7	0.997 -	1.256:	3
8	1.256 -	1.581:	0
9	1.581 -	1.991:	1
10	1.991 -	2.507:	1
11	2.507 -	3.158:	0
12	3.158 -	3.976:	0
13	3.976 -	5.007:	0
14	5.007 -	6.306:	0
15	6.306 -	7.941:	0
16	7.941 -	10.000:	0
	Mean:		0.549
	Std. Dev.:		0.483

200 mm Tantalum
1.5PSI 89/78 RPM DaNano 185ml/min

Total defect > 0.25 μ = 33

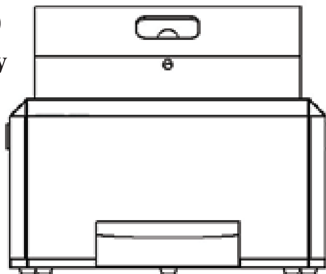
NANO-MASTER Single Wafer/Mask Cleaning Systems

SWC GENERAL SPECIFICATIONS	
Maximum Wafer Size:	12”
Maximum Mask Size:	7”x7”
Typical Clean Time:	5 minutes
Megasonic Frequency:	1 MHz
RF Power Supply Maximum Output:	40 watts
Minimum DI Water Flow:	1.5 liter/minute
Maximum Spinner Speed:	2000 RPM
System Control:	Microprocessor controlled with PLC programming
Loading and Unloding:	Manual
N_2 Heater (option):	70°C

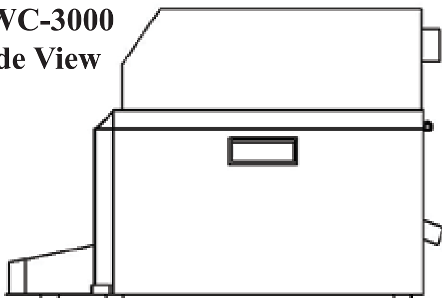
FACILITY REQUIREMENTS	
Power Input:	110V, 15A or 230V, 15A, 50/60Hz
CDA Input:	2.2 cfm @ 70-80 psi for internal vacuum pump
Chemical Dispense Rate:	@15PSI of N_2, 83ccm @20PSI of N_2, 133ccm
Drain:	1” OD pipe
Nitrogen:	40 PSI
Exhaust (System):	1-2 cfm, 1” FNPT, 400mm Hg
Oxygen for Ozonated DI Water (option)	15 PSI

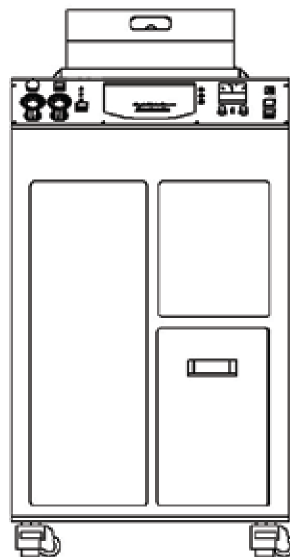
DIMENSIONS	Width	Depth	Height
SWC-3000	19”	26”	16 1/2”
SWC-4000	28”	32”	54”
RF Power Supply	11 1/4”	17”	6”
N_2/Dual Drain Box	8 1/4”	10 1/4”	13”
Chemical Box	9”	23”	14”

SWC-3000 Front View



SWC-3000 Side View





SWC-4000 Front View

SWC-4000 Side View

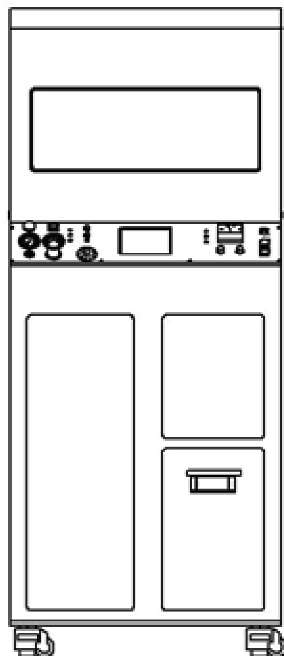
NANO-MASTER Single Wafer/Mask Cleaning Systems

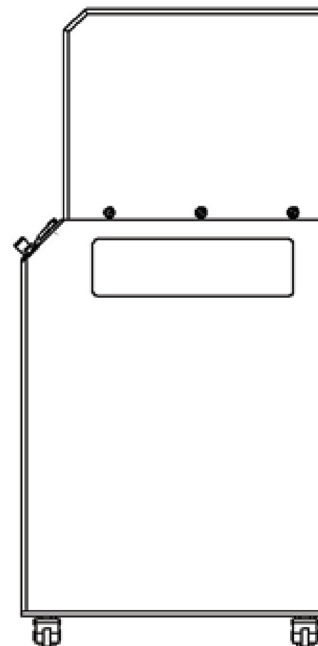
LSC GENERAL SPECIFICATIONS	
Maximum Wafer Size:	21” OD
Maximum Mask Size:	15 ”x 15”
Typical Clean Time:	5 minutes
Megasonic Frequency:	1 MHz or 3 MHz
RF Power Supply Maximum Output:	40 watts
Minimum DI Water Flow:	1.5 liter/minute
Maximum Spinner Speed:	4000 RPM
System Control:	PC controlled with LabVIEW and touchscreen user interface
Loading and Unloding:	Manual
N_2 Heater (option):	70°C

FACILITY REQUIREMENTS	
Power Input:	208V, 20A or 400V, 20A, 50/60Hz
CDA Input:	2.2 cfm @ 70-80 psi for internal vacuum pump
Chemical Dispense Rate:	@15PSI of N_2, 83 ccm @20PSI of N_2, 133 ccm
Drain:	2 x 1.0” male flare connections for solvent and acid drains
Nitrogen:	40 PSI
Exhaust (System):	2.2 cfm, 1” FNPT, 400mm Hg
Oxygen for Ozonated DI Water (option)	15 PSI

DIMENSIONS	Width	Depth	Height
LSC-4000	28”	32”	72”

Front View





Side View

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