Matrix System 1- Strip & Etch
Models 104, 105, 145, 106, 111, 303

Field Proven System 1 150mm Platform

- RF powered and Downstream, isotropic processing
- Reliable, Simple to Operate
- >750 in field
- Small Footprint: 25”W x 28”D
- Low CoO
- CE and UL 1262 Compliant
- Model 111
  - High Rate, No-Damage, Resist Strip (2.25-3.5 um/min)
- Model 106
  - High Temperature Resist Strip (up to 300°C)
- Model 105
  - Moderate Temperature Resist Strip (80-250 °C)
  - Descum / Clean, MEMS Applications
- Model 104
  - Low Temperature (25-100 °C), Controlled Resist Clean / Descum & Surface Preparation, Metal De-Oxidation
- Model 145
  - Low Temperature (25-100 °C), Controlled Resist Clean / Descum
- Model 303
  - Isotropic Etch of Oxides, Nitride, SiChrome, Low K, BCB



Matrix System 1
Through-the-Wall Configuration

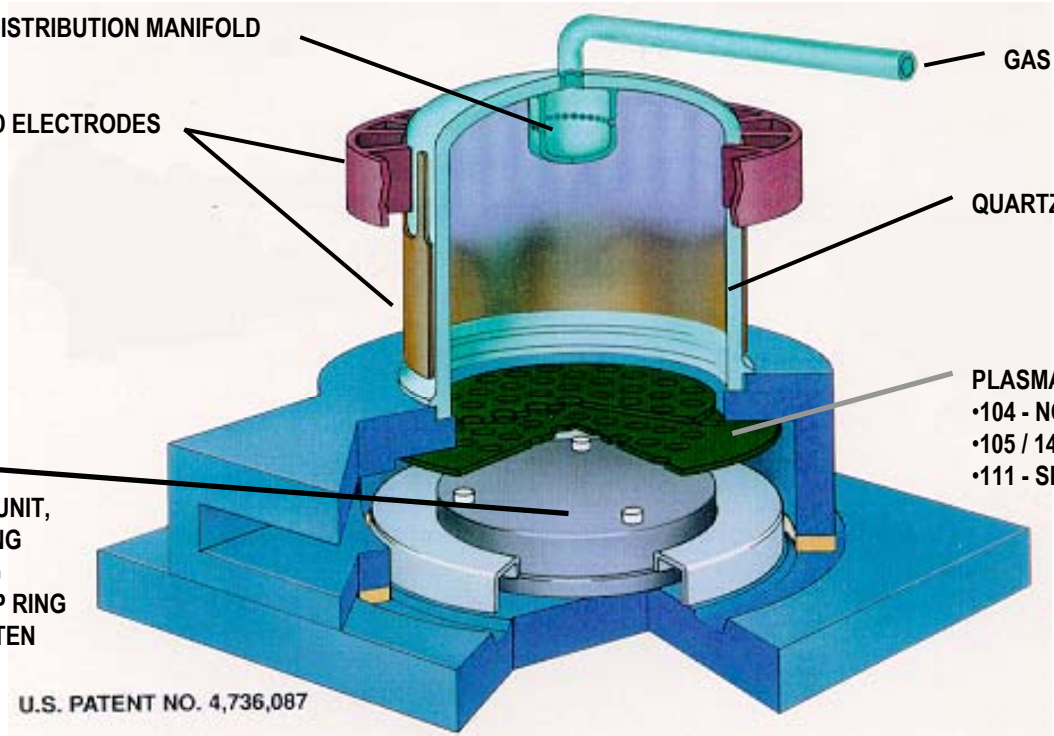
- Saves valuable fab Bay floor space
- Available as Models 204, 205, 245, 206, 211, 403
- Similar footprint in chase area as stand alone style
- Only cassette, robot and display project into Bay.



System 1 Uptime

- MTBF: > 450 hours
- MTTA: > 100 hours
- MTTR: < 3.5 hours
- Overhead (non-plasma): < 32 seconds

System 1 Resist Strip Reactor



Matrix System 1
Model 111

High Rate, No-Damage Strip Technology

Model 111 Stripper
Featured Enhancements

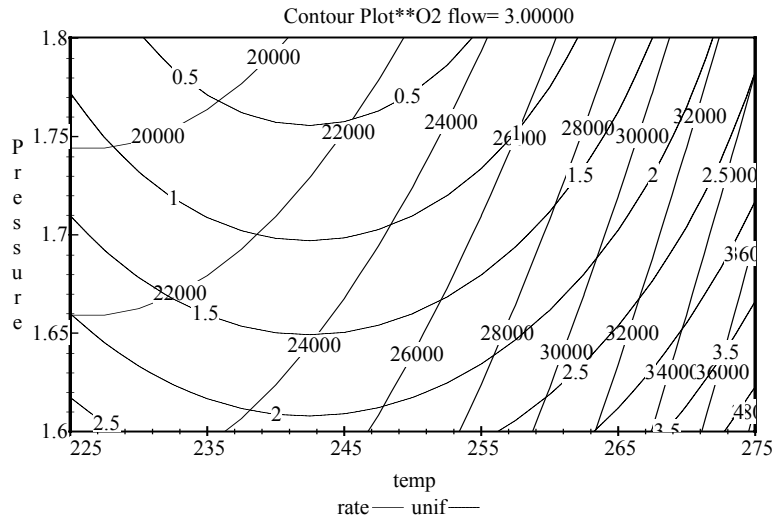
Enhancements for System 111 over Models 106/105:

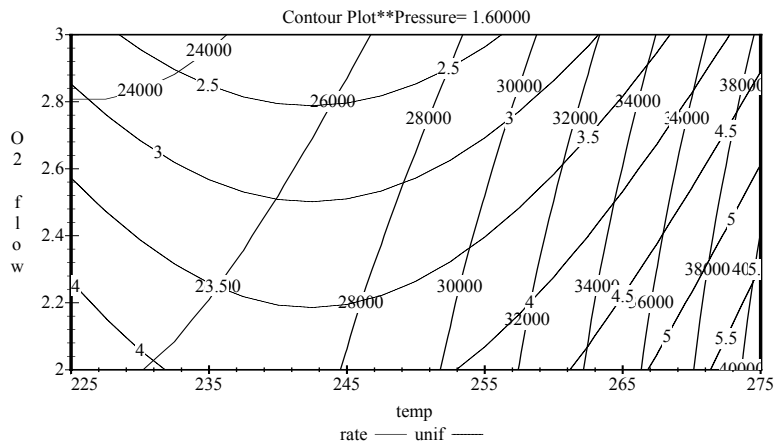
- Silicon Baffle
  - Effectively “getters” ion species, lowering plasma damage threshold
  - Prevents plasma coupling that’s possible in dual quartz baffle arrangement, see CHARM data
  - No ion leakage permits operating at lower pressure, higher flow, in a faster rate regime
  - Laser drilled holes, and very thick substrate for longevity/reliability
  - Compatible with typical process gases and applications: high dose implant, post etch, descum, etc.
- Anti-Skate, High Temperature Chuck
  - Chuck Temperature range 125 °C - 300 °C
  - Anti-Skate feature enables atmospheric wafer pre-heat at any chuck temperature
  - A-S chuck thermally isolated from chamber base plate, eliminating water cooling of baseplate
- Upgraded Software version 4.07CX18 enables Pre-heat
  - Pre-heat of just 4 seconds(user selectable) can increase strip rate up to 100%
  - No system overhead time penalty for pre-heat
- Wafer cool down station
  - Allows wafer cooling with small increase in system overhead time
- Higher Gas Flow, Lower Pressure capability
  - Add blower to standard roughing pump: 165 CFM (@200mtorr) pump speed, I.e.QDP40/250
- Throughput increase can be 10-50%, depending on process
- Model 111 Upgrade from 105/106 is Field Retrofittable and Cost Effective

System 1, Model 111
150mm Performance

Specification

- **SPECIFICATION** Rate: 2.2 - 3.7 *u*/min.
  (@ 225 to 275 deg C.) bulk strip
  1000 A/min descum
- Removal Uniformity: <15% (3 sigma) Strip
  <10% (3 sigma) Descum
- Temperature Control: 125 - 300°C (±2°C)
- Process Range (for bulk strip application)
  - Pressure: 1.6 to 1.8 torr
  - Power: 375-475 W
  - Flow: 2.0-4.0 liters O2
  - Endpoint: Diode array
- Particulates: <0.05/cm² (0.03µm or greater)
- Damage
  - CV: <0.1V from control
  - Mobile Ion: <1-2 E^{10}
  - Vt: 0% total shift on 98% of points tested, no shift >5%





Actual

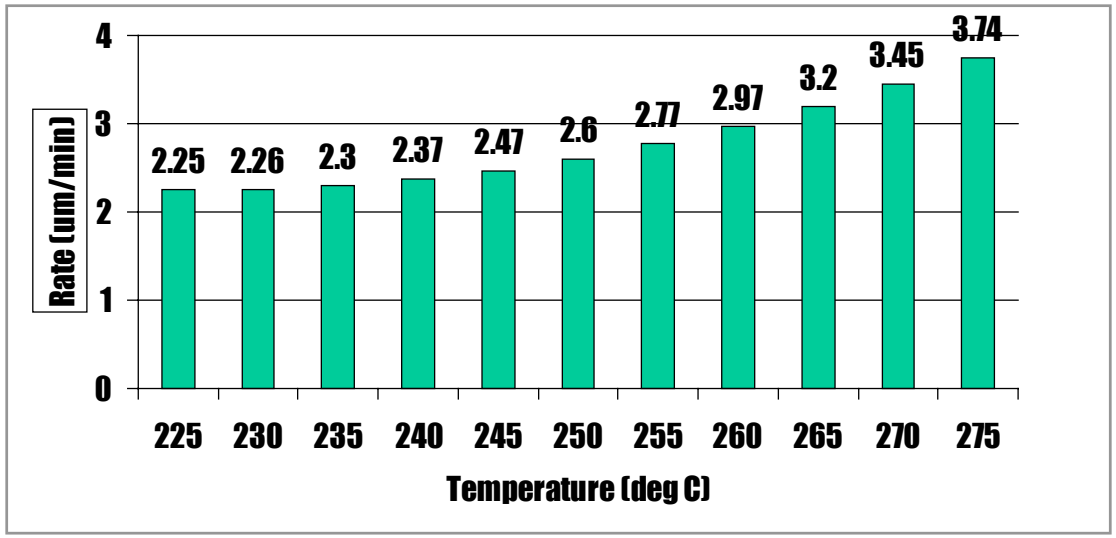
- **ACTUAL Rate:** **2.7 um/min (@30 sec partial strip)***
- **Removal Uniformity:** **6.0% (3 sigma)** **(6mm edge exclusion)**
- **Temperature Control:** **250°C (±5°C)**
- **Process Conditions**
  - **Pressure:** **1.6 torr**
  - **Power:** **450 W**
  - **Flow:** **O_2 3.0 liters**

*Resist Type: AZ1350J
Thickness: 1.5 um
Bake Temp: 120 deg C

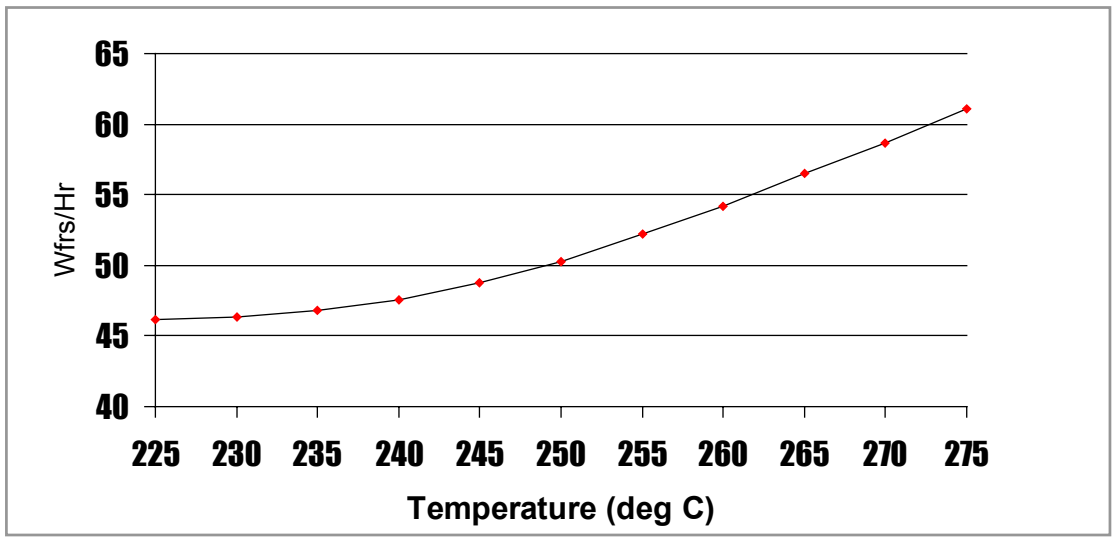
Matrix confidential

System 1, Model 111 Performance

Rate vs. Temperature



Throughput vs. Temperature

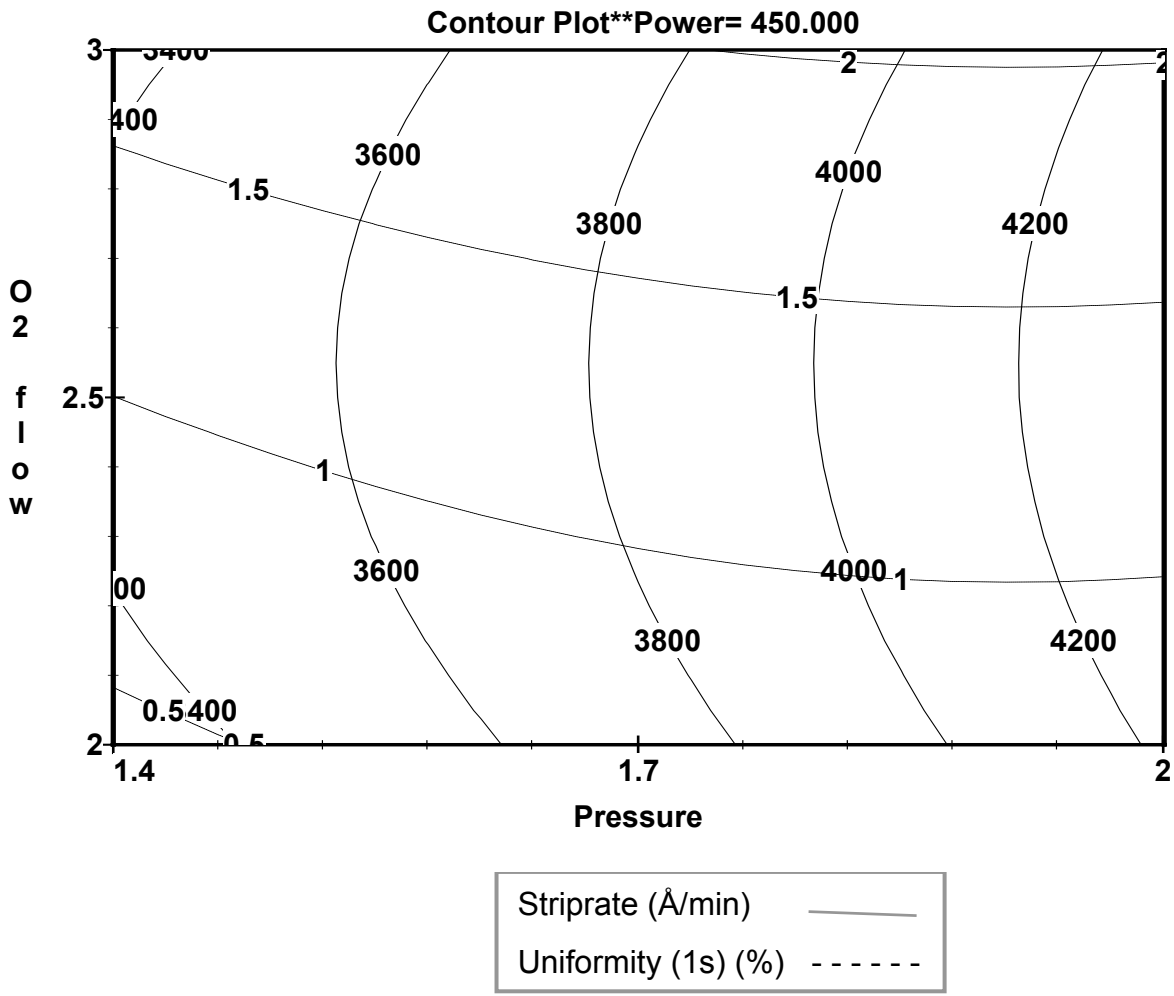


System 1, Model 111
Process Characterization Data

Run	temp	Pressure	O2 flow	rate	unif
1	225	1.6	2	25764	4.3
2	225	1.7	3	21149	1.9
3	225	1.8	2.5	20184	1.5
4	250	1.6	3	26932	2
5	250	1.7	2.5	25928	1.9
6	250	1.8	2	24829	2.3
7	275	1.6	2.5	39887	5.5
8	275	1.7	2	38518	4.6
9	275	1.8	3	33416	2.3

System One Model 111
Low Temperature Strip / Descum
DOE Experimental Results

- 4” Wafer Results:
- Using 3.9µ AZ 1547 Resist
- DOE Variables
  - 1.4 - 2.0 Torr
  - 2-3.0 SLPM O_2
  - 250 - 450 Watts RF
  - 150° C
  - 60 seconds
- Excellent Results:
  - >3600 A/min
  - <1.5% 1σ uniformity
- 6” Results similar



System One Model 111
Charm-2 Wafer Damage Results

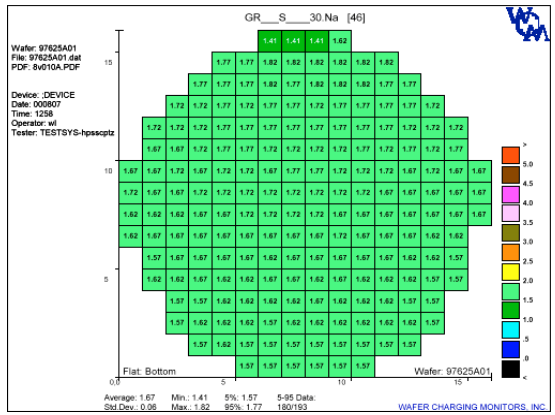
Charm Wafer Sensor Response*

- Peak Voltage Potentials
  - < +1.8 Volts (95%) **None***
  - < -2.4 Volts (95%) **Slight**
- Charge Flux **None***
  - < +0.6uA/cm2 @ 1.8 V (95%)
  - < -0.3uA/cm2 @ -1.7 V (95%)
- UV Response **None***
  - range 3.2-8eV(138nm-388nm)

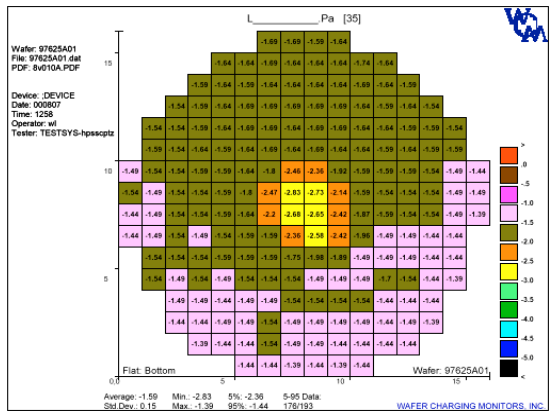
- Process Recipe: Standard Strip
  - 1.6T / 450W / 3.0LPM / 250C / 15sec
  - Bare wafer tested without resist

- **No Damage Mechanisms***
- No charge flux = No Damage Potential

*Reported by Wafer Charging Monitors, Inc. August 7, 2000, 150mm wafer



Positive potentials after processing



Negative potentials after processing

Matrix System 1
Model 106

High Temperature
Photoresist Stripper

Model 106 Stripper
Featured Enhancements

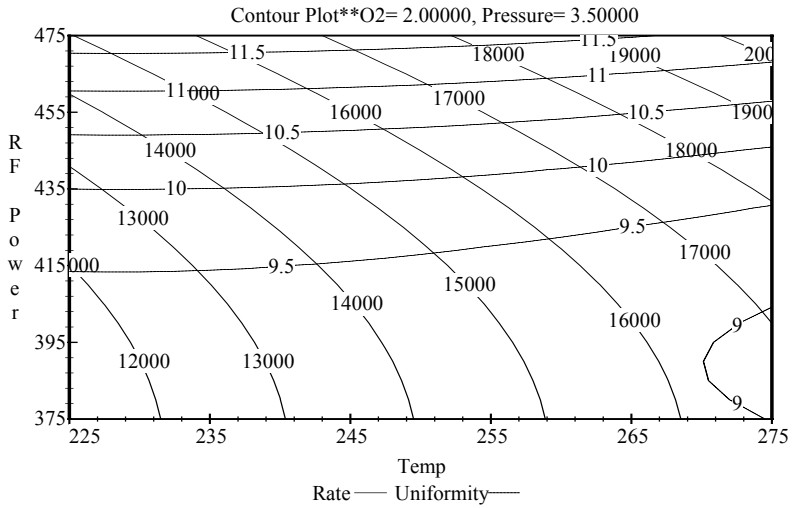
Enhancements for System 106 over Model 105:

- High-Temperature, Center-Draw Wafer Chuck
  - Chuck Temperature range increased to 300°C maximum
  - Higher wafer temperature increases strip rate
- Center-Draw Chuck Design improves chamber flow dynamics
  - Improves process window & uniformity
  - Reduces parts, eliminates pump ring, improves maintenance
- Thermally isolated chuck & baseplate
  - Eliminates need for baseplate water cooling
- Wafer cool down station
  - Allows wafer cooling with small increase in system overhead time
- Throughput increase can be 10-25%, depending on process
- Model 106 upgrade from Model 105 is field-retrofittable and cost effective
- Model '105CD' has Center-Draw Chuck improvement only vs Model 105.

System 1, Model 106
150mm Performance

Specification

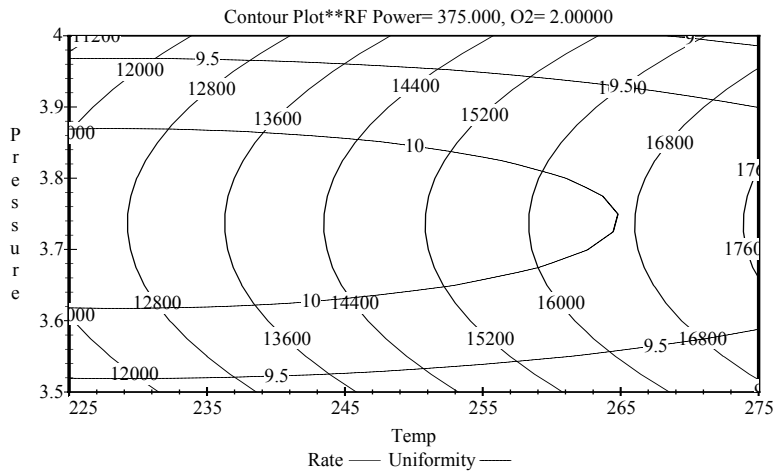
- **SPECIFICATION** Rate: 1.1 - 2.0 *u*/min.
  (@ 225 to 275 deg C.) bulk strip
  1000 A/min descum
- Removal Uniformity: <15% (Max-Min) Strip
  <10% (Max-Mn) Descum
- Temperature Control: 125 - 300°C (±2°C)
- Process Range (for bulk strip application)
  - Pressure: 3.0 to 5.0 torr
  - Power: 375-475 W
  - Flow: 1.0-2.5 liters O2
  - Endpoint: Diode array
- Particulates: <0.05/cm² (>0.03µm)
- Damage
  - CV: <0.1V from control
  - Mobile Ion: <1-2 E^{10}
  - Vt: 0% total shift on 98% of points tested, no shift >5%



Actual

- ACTUAL Rate: 2.0 um/min (@30 sec partial strip)*
- Removal Uniformity: 10.4% (max-min) (6mm edge exclusion)
- Temperature Control: 275°C (±5°C)
- Process conditions
  - Pressure: 4.0 torr
  - Power: 425 W
  - Flow: O_2 1.75 liters

*Resist Type: AZ1350J
Thickness: 1.5 um
Bake Temp: 120 deg C



Matrix System 1
Model 105

Photoresist Stripper
& Descum Tool

System 1, Model 105

150mm Performance

Specification

SPECIFICATION Rate:	0.8 - 1.5 u/min. (@ 200 to 250 deg C.) bulk strip
	1000 A/min descum@150C
Removal Uniformity:	<15% (Max-Min) Strip
	<15% (Max-Mn) Descum
Temperature Control:	80 - 250°C (±2°C)
Process Range (for bulk strip application)	
Pressure:	3.0 to 5.0 torr
Power:	250-475 W
Flow:	1.0-2.5 liters O2
Endpoint:	Diode array
Particulates:	<0.05/cm² (0.03µm or greater)
Damage	
CV:	<0.1V from control
Mobile Ion:	<1-2 E^{10}
Vt:	0% total shift on 98% of points tested, no shift >5%

Actual

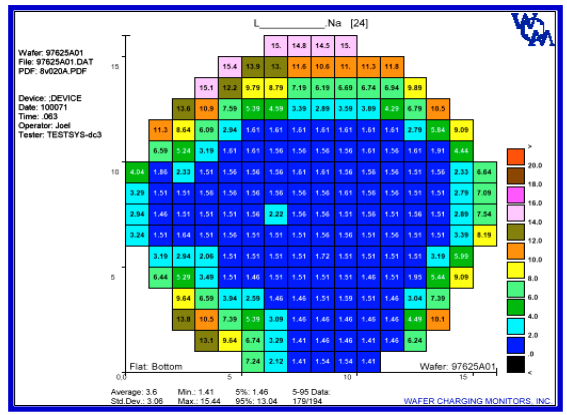
ACTUAL Rate:	1.5 um/min (@30 sec partial strip)*		
Removal Uniformity:	10% (max-min) (6mm edge exclusion)		
Temperature Control:	250°C (±5°C)		
Process conditions			
Pressure:	4.0 torr		
Power:	425 W		
Flow:	O_2 1.75 liters	*Resist Type:	AZ1350J
		Thickness:	1.5 um
		Bake Temp:	120 deg C

System One Models 105 / 106
Charm-2 Wafer Damage Results

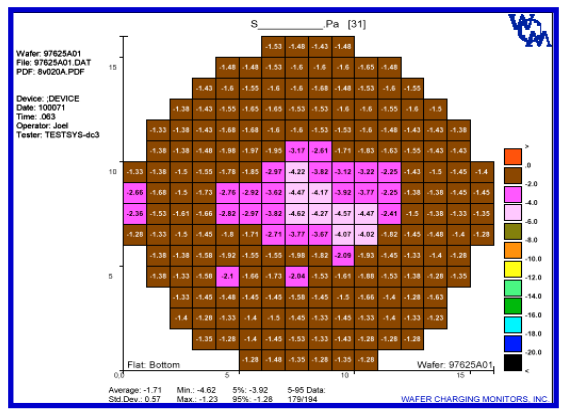
Charm Wafer Sensor Response*

- Peak Voltage Potentials
  - < +13.0 Volts (95%)
  - < -3.9 Volts (5%)
- Charge Flux
  - < +60.0 uA/cm2
  - < -100.0 uA/cm2
- UV Response **None***
  - range 3.2-8eV(138nm-388nm)
- Process Recipe: Standard Strip
  - 4.0T / 425W / 1.75LPM / 250C / 20sec
  - Bare wafer tested without resist
- Charging potential is a function of gate oxide quality and integrity, and should be qualitatively measured by customer

*Reported by Wafer Charging Monitors, Inc. July 14, 2000, 150mm wafer



Positive potentials after processing



Negative potentials after processing

Model 145 Stripper
Featured Enhancements

Comparison of System 145 Features to Model 105 and Model 104:

- Model 145 combines Hardware of the Models 105 and 104:
- 105 style Chamber and Quartz Baffle
  - 'Downstream' plasma processing for Semiconductor IC applications
  - Baffle improves flow dynamics for improved etch uniformity
- 104 style Wafer Chuck and Baseplate
  - Electrically Grounded Chuck increases etch rate (vs Model 105) at low temp: <100°C
  - Chuck can utilize external Temp Control Unit for Stable Temperature +/-2C
- Model 145 is best choice for applications requiring:
  - Excellent Uniformity
  - Stable process temperatures below 100°C (Setpoint +/- 2°C)
  - Downstream processing for reduced "Plasma Charging effects"
  - Organic Cleaning of Photonic Switch or MEMS Structures combining IC circuitry
- Model 145 upgrade from Model 105 or 104 is field-retrofittable and cost effective

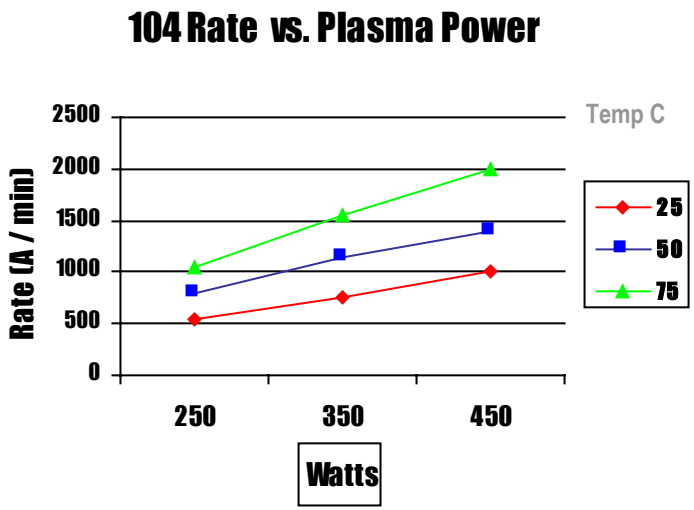
Matrix System 1
Model 104

Low Temperature
Organic Clean / Descum Processing

System 1, Model 104
150mm Performance (Descum/Clean)

Specification

SPECIFICATION Rate:	500-2,000 Å/min. (@ 25 - 75 deg C.) strip
Removal Uniformity:	<15% (Max-Min)
Temperature Control:	20-90°C (±2°C)
Process Range (for descum application)	
Pressure:	1.0 to 5.0 torr
Power:	100-500 W
Flow:	200-500 sccm O2
Endpoint:	Diode array
Particulates:	<0.05/cm² (>0.03µm)
Damage	
CV:	<0.1V from control
Mobile Ion:	<1-2 E^{10}
Vt:	0% total shift on 98% of points tested, no shift >5%



Actual

ACTUAL Rate:	2000Å / min(@60 sec partial strip)*
Removal Uniformity:	15% (max-min/2 avg) (6mm edge exclusion)
Temperature Control:	75°C (±2°C)
Process Range	
Pressure:	3.5 torr
Power:	450 W
Flow:	O_2 400 sccm

*Resist Type: g-line
Thickness: 1.5 um
Bake Temp: 110 deg C
Bake oven time: 30 min

Model 104 System 1
TFH Applications

- Pre-Metal Deposition Clean
- Pre-Plate Descum
- Pre-Wet-Etch Descum
- Pre-Gap Etch Descum
- Ion Milled Resist Surface Removal
- Resist Thinning
- Resist Stripping
- Adhesion Promotion
- Resist Removal Before Lapping
- Resist Surface Clean
- Metal Oxidation