



**Chuck Cleaning Wafer (CCW)** to remove dusts / particles on wafer chuck (Electrostatic, Vacuum, Mechanical) to be cause of machine troubles

**[Contact]**

**KYODO INTERNATIONAL INC.**

<http://www.kyodo-inc.co.jp/>

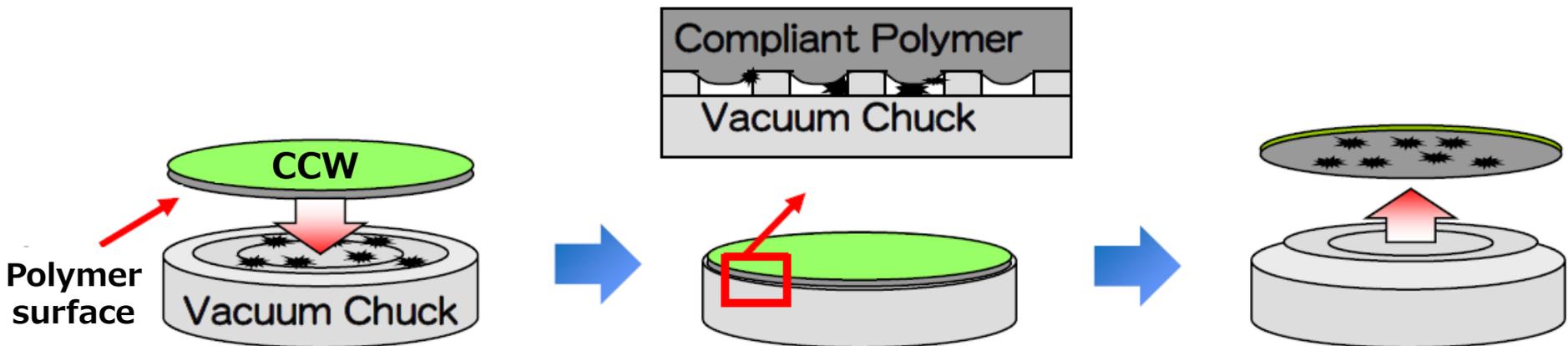
2-10-9 Miyazaki Miyamae-ku, Kawasaki-shi,  
Kanagawa-ken, 216-0033 Japan  
TEL:+81-44-852-7575 FAX:+81-44-854-1979

email:denshi@kyodo-inc.co.jp

# About Chuck Cleaning Wafer (CCW)



A cleaning wafer to remove dusts or particles on wafer chucks. A polymer pasted on the surface of a silicon wafer absorbs dusts or particles when it contacts with the chuck. Customers can realize the effect of the performance of the CCW by carrying it like as same as production wafers.



Put the polymer surface of the CCW on the chuck surface where particles exist

The polymer is absorbed onto the chuck surface by the vacuum absorption effect of the chuck. The polymer has elasticity

Particles stick to the polymer and removed

# Chuck Cleaning Wafer (CCW) shows superior effect in the following points



- ✓ **The number of dummy wafers to be run after chamber cleaning (after PM / trouble occurrence) is greatly reduced.**  
(e.g. before CCW use : 50pcs ➔ after CCW use : 2-3pcs)
- ✓ **Photolithography** : It solves the problem of hot spot which causes focus defect.
- ✓ **Etching** : It solves the Helium leak problem caused by dust on the chuck.
- ✓ **Sputtering** : It solves the Helium leak problem caused by dust on the chuck.  
It also contributes to improvement of thin film uniformity.
- ✓ **CCW for etching and sputtering process can be recycled more than once by using Particle Removal Film (PRF).**

# As a result, manufacturing loss at downtime is greatly improved : Case-1



## In Photolithography

### 【Assumption / trial calculation】

- Hot spot occurred 4 times / month for each equipment
- Set the throughput to 130 wafers / hour
- Set the occupancy rate to 80%
- Includes equipment startup time in downtime

### 【Estimate of the amount lost in an hour】

In the case of 300mm : @250,000/Hr

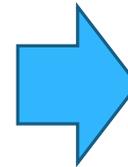
In the case of 200mm : @90,000/Hr

(Depreciation, labor costs, utilities, parts for wet clean, downtime etc. )

### 【Estimate the number of wafers that were not processed during that time】

In the case of 300mm : 104 wafers

In the case of 200mm : 104 wafers



## With CCW operation,

- CCW usage times : 50 times
- Remove 75% of hot spot

### 【In the case of 300mm】

- Cost reduction of ¥ 3,300,000 / batch
- Throughput improvement for 3,900 wafers

### 【In the case of 200mm】

- Cost reduction of ¥ 3,300,000 / batch
- Throughput improvement for 3,900 wafers

# As a result, manufacturing loss at downtime is greatly improved : Case-2



## In Etching

【Assumption / trial calculation】

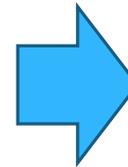
- Helium leak occurred 2 times / month for each equipment
- Necessity for outsourcing to replacement parts and external cleaning occurs
- Set the throughput to 37 wafers / hour
- Set the occupancy rate to 80%
- Includes equipment startup time in downtime

【Calculate the amount of loss that will be lost in 8 hours downtime】

In the case of 300mm : ¥750,000  
(Depreciation, labor costs, utilities, parts for wet clean, downtime etc. )

【Estimate the number of wafers that were not processed during that time】

In the case of 300mm : 240 wafers



## With CCW operation,

- CCW usage times : 20 times (100 times possible with PRF)
- 75% reduction in Helium leak generation

【In the case of 300mm】

- Cost reduction of ¥ 11,100,000 / batch
- Throughput improvement for 3,600 wafers

→ You can extend the interval of wet cleaning

# As a result, manufacturing loss at downtime is greatly improved : Case-3



## In Sputtering

【Assumption / trial calculation】

- Helium leak occurred 2 times / month for each equipment
- Necessity for outsourcing to replacement parts and external cleaning occurs
- Set the throughput to 37 wafers / hour
- Set the occupancy rate to 80%
- Includes equipment startup time in downtime

【Calculate the amount of loss that will be lost in 8 hours downtime】

In the case of 300mm : ¥1,100,000  
(Depreciation, labor costs, utilities, parts for wet clean, downtime etc. )

【Estimate the number of wafers that were not processed during that time】

In the case of 300mm : 224 wafers



## With CCW operation,

- CCW usage times : 20 times (100 times possible with PRF)
- 75% reduction in Helium leak generation

【In the case of 300mm】

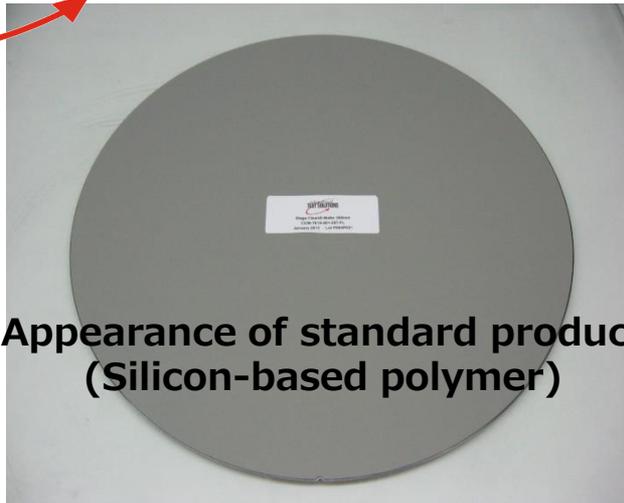
- Cost reduction of ¥ 16,000,000 / batch
- Throughput improvement for 3,360 wafers

→ You can extend the interval of wet cleaning

# CCW product introduction (Material, Optional processing)

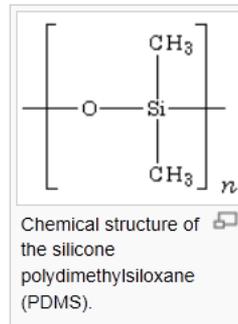
international  
**TEST SOLUTIONS**

CCW was developed by International Test Solutions (ITS), USA



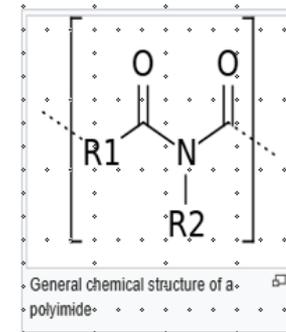
Appearance of standard product  
(Silicon-based polymer)

Silicon-based polymer  
For (Etch, PVD)



PDMS  
= Poly(dimethylsiloxane)  
= R<sub>2</sub>SiO

Polyimide-based polymer  
For (Photo-litho)



POLYIMIDE



3D processing of polymer to be tailored to chuck shape is available

Appearance of 3D processed surfaces: (Only available for Silicon-based polymer)

# CCW product introduction (Type)



## Size and rate of dust captured by CCW

1 $\mu$ m : 99.7%  
0.5 $\mu$ m : 75%  
0.5~0.2 $\mu$ m : 50%

## Types of viscosity of CCW

0.1, 0.2, 0.5, 1.0  
Weak ← → Strong

Type	Cleaning side	Process	Available wafers (mm)	Heatproof temperature	PRF utilization	Recyclable times (ref)	3D process
Coat	Polyimide	Photolitho	200, 300	-50~200℃	×	15 times (approximate)	×
	Silicon	Etching/Sputtering	200, 300	-50~300℃(customizable)	✓	15 times (approximate) MAX100 times (with PRF)	
Paste	Silicon	Etching/Sputtering /Photolitho	100, 125, 150, (200, 300)	-50~200℃ (300℃)			

# CCW product introduction (Advantages against for competitors' products)



- \* It has stronger adhesiveness
- \* It has options of stickiness selection
- \* The polymer has elasticity related to the surface and the layer thickness
- \* 3D processing is possible
- \* Operating temperature range is -50 °C to 200 °C  
(For sputtering, there are also options up to 300 °C )
- \* By using PRF (Particle Removal Film), it is possible to use CCW repeatedly by removing dusts and particles from the polymer surface captured by CCW (Estimated extend life with PRF : 100 times)

**Explanation in page 11**

# CCW product introduction (Quality)



- \* It is possible to use CCW in customer's existing wafer processing environment / equipment
- \* We manufacture CCW in the clean room environment
- \* There is no transfer from polymer to chuck during usage (Except in case of polymer breakage due to excessive use)
- \* It does not cause heavy metal contamination (TXRF = Total reflection fluorescent X-ray analysis)
- \* There is no release of gases from the polymer within the operating temperature range (Confirmation with NASA standard ASTM E595)
- \* The shelf life (shelf life) is 2 years after production

# About Particle Removal Film (PRF)

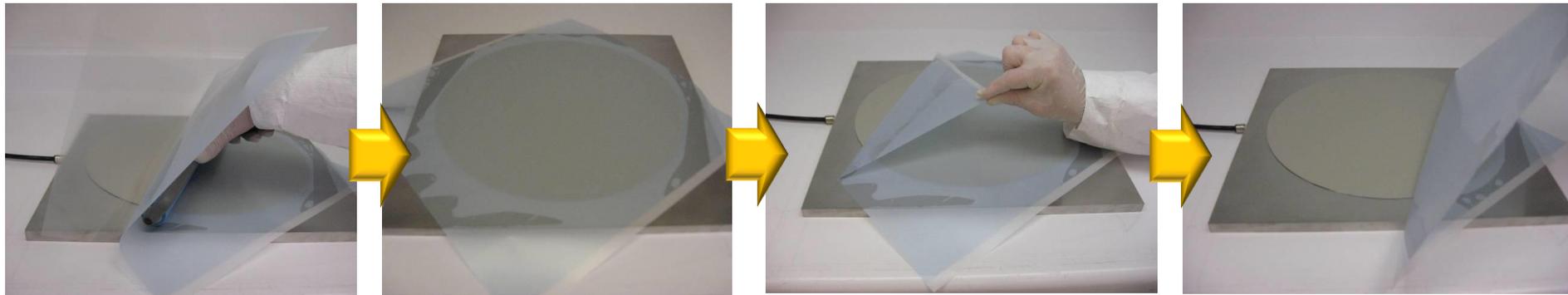
For **Etching** and **Sputtering** process

It is a cleaning sheet to use CCW repeatedly  
You can reuse CCW up to ~ 100 times



Protection film
Cleaning polymer (Strong tackiness)
Holding film / sheet

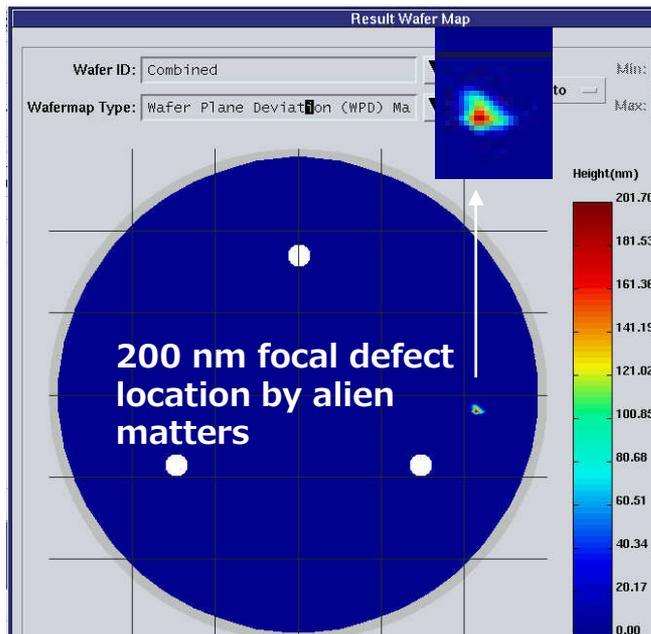
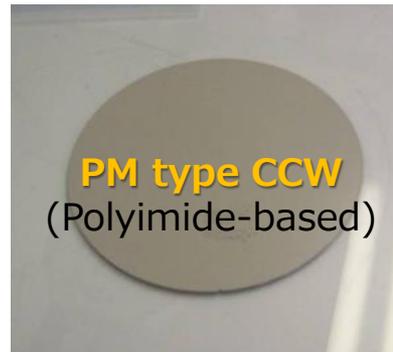
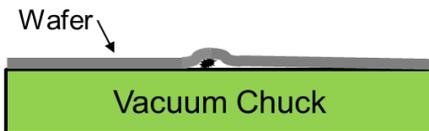
- ✓ Can be used for Silicon pasting type only
- ✓ 13,9,7 inch size
- ✓ 10 pcs 1 set



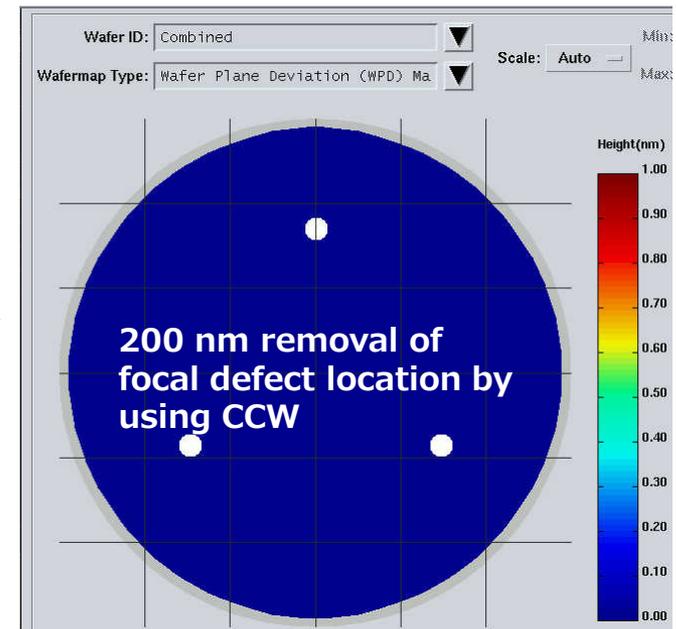
1. Remove protection film of PRF
2. Crimp PRF on CCW surface with roller
3. Remove PRF from CCW surface
4. Transfer of dusts from CCW surface to PRF
5. Discard PRF sheet

# Effect of CCW utilization (Photolithography : ①)

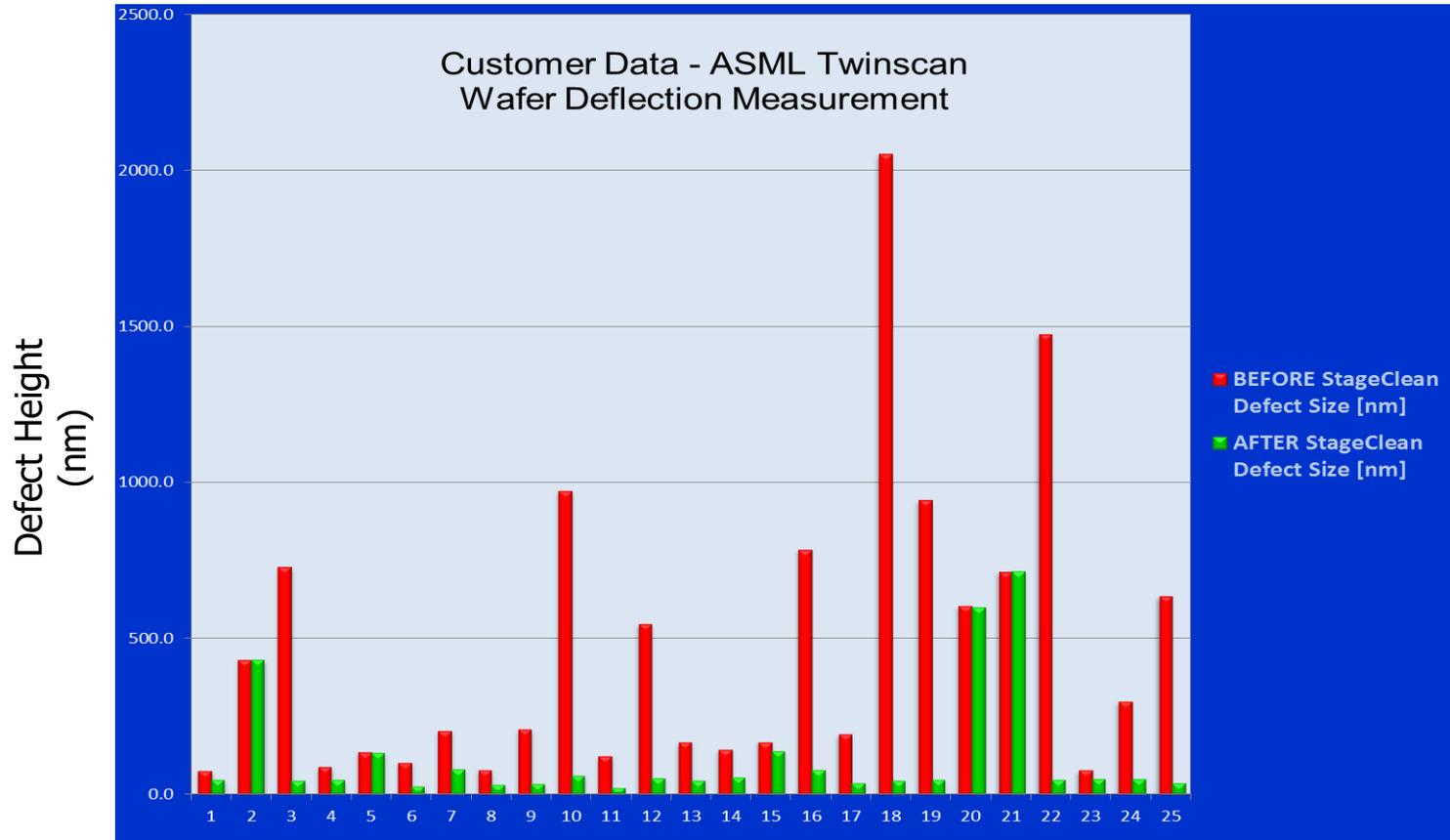
It solves the defective focus due to dusts on the chuck and contributes to the improvement of yield



Remove alien matters without opening chamber



# Effect of CCW utilization (Photolithography : ②)

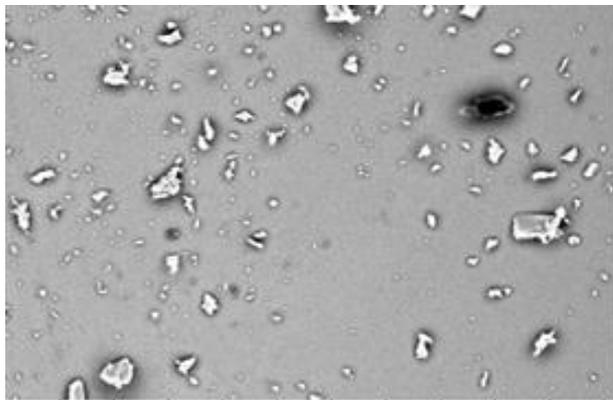
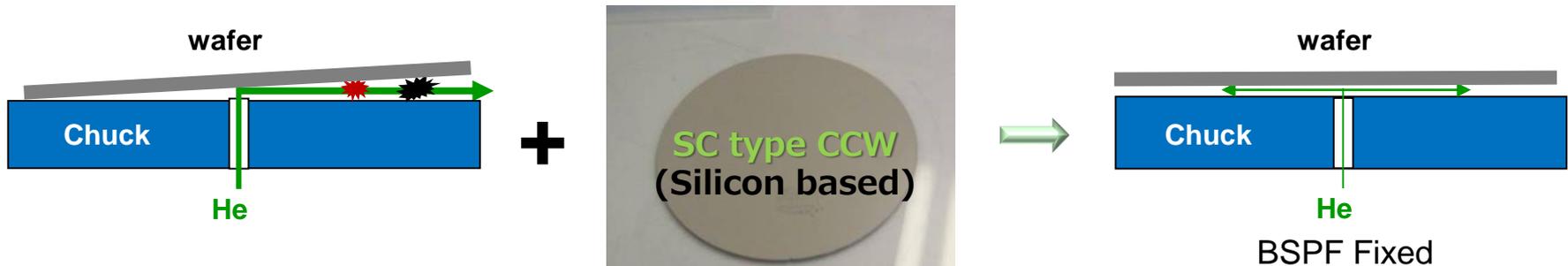


- When dusts/particles larger than 120 nm are detected, CCW performs well
- It is also effective for removing dusts/particles smaller than 100 nm -successful rate is approximately 80% -

# Effect of CCW utilization

## (Etching : ①)

It solves the problem of Helium leakage caused by dusts/particles on the chuck and contributes to improvement of yield. It also omits the extra wet cleaning process. Customers can head off the loss of dummy wafers to a minimum level after PM

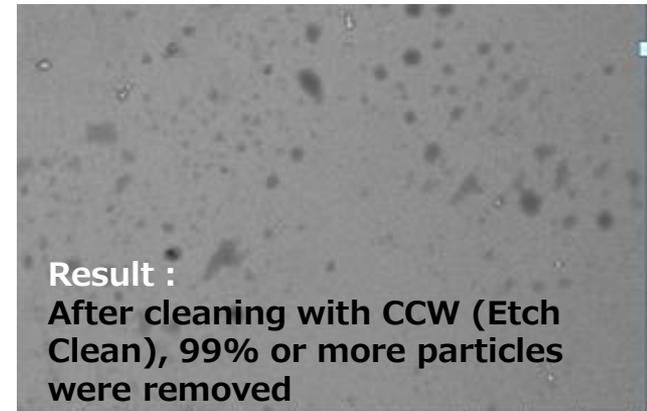


12/01/11 19:05 D3.2 x500 200 um

Surface SEM observation  
before and after cleaning



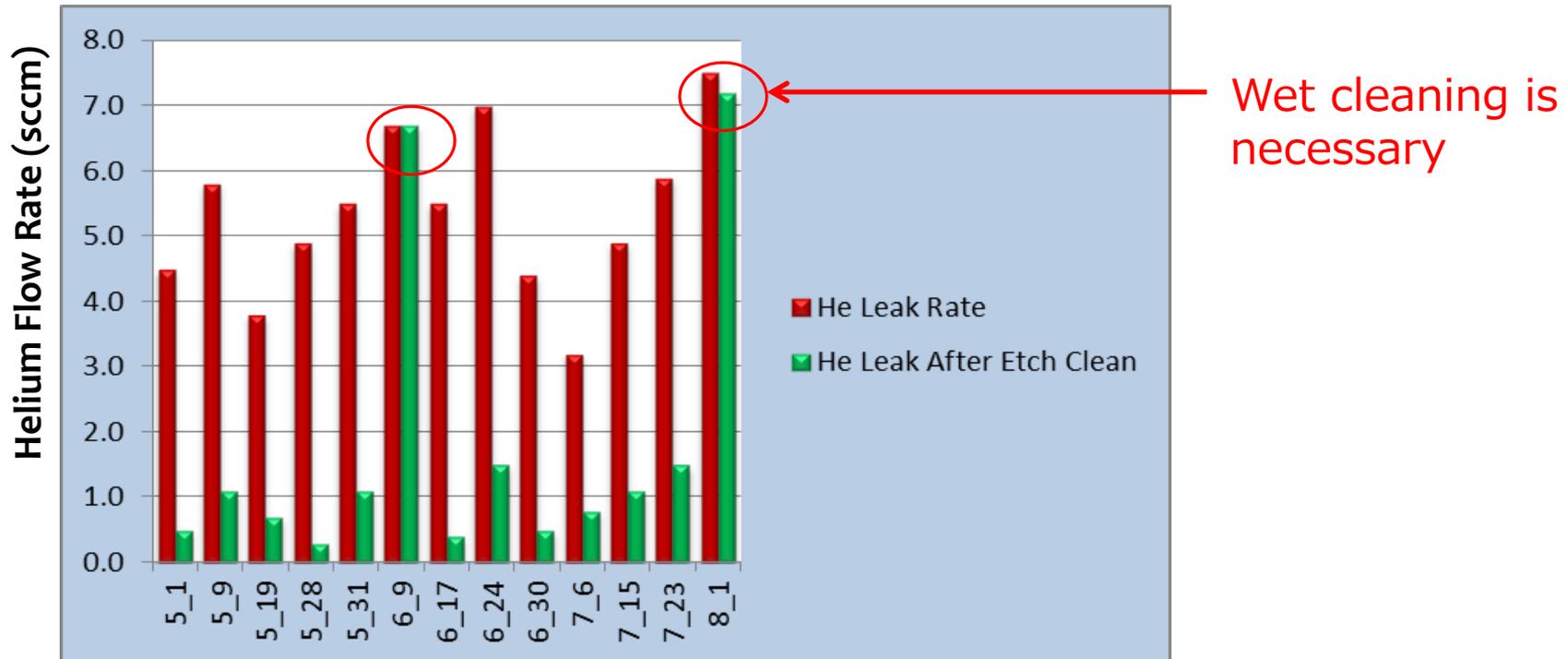
Remove alien  
matters without  
opening chamber



Result :  
After cleaning with CCW (Etch  
Clean), 99% or more particles  
were removed

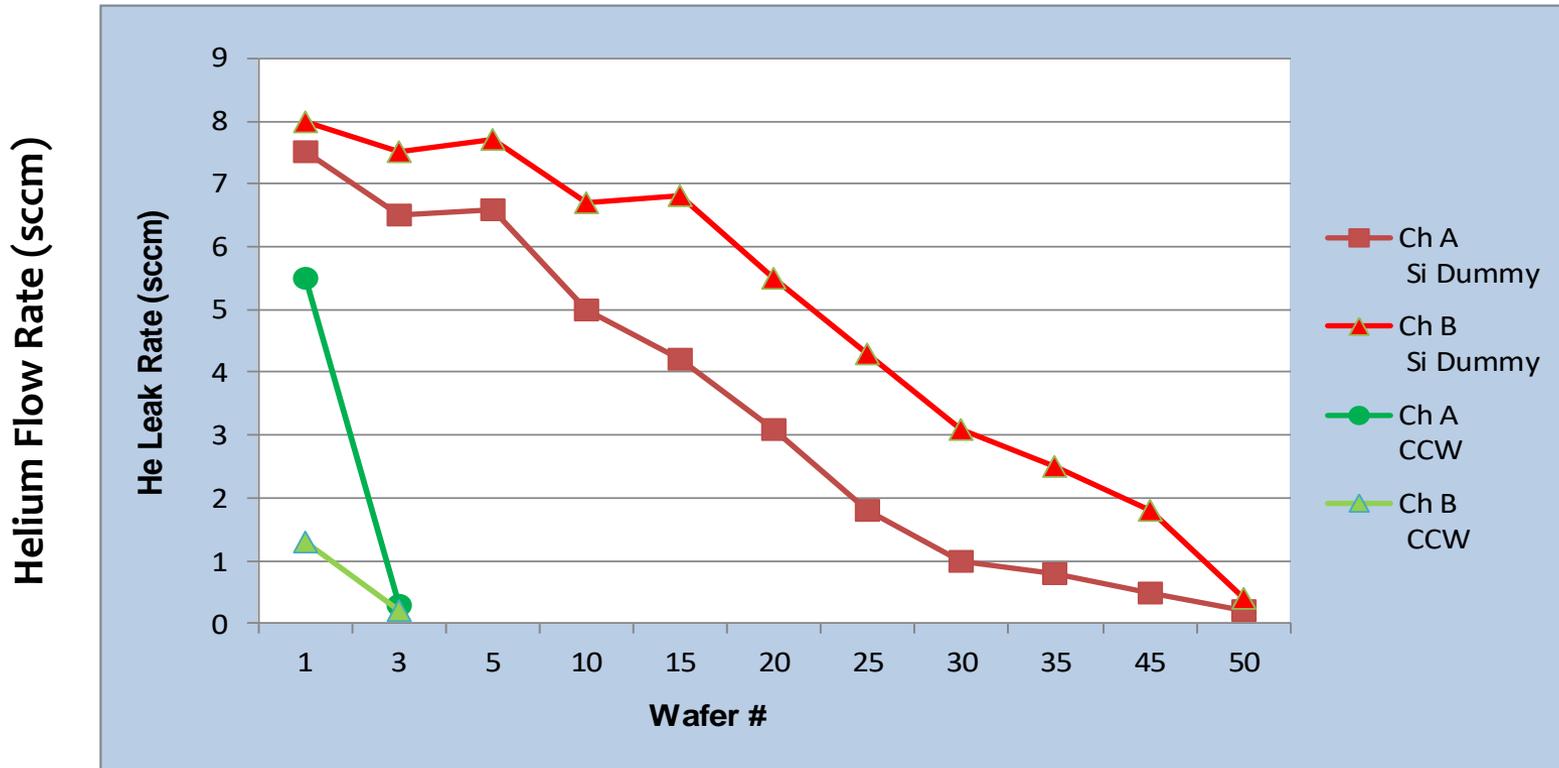
12/01/11 19:30 D3.1 x500 200 um

# Effect of CCW utilization (Etching : ②)



- 200mm LOGIC – Metal Etching
- HE flow rate observation during 3 months before and after CCW (Etch Clean) in 3 chamber · environment:  
sccm = standard cubic centimeter per minute

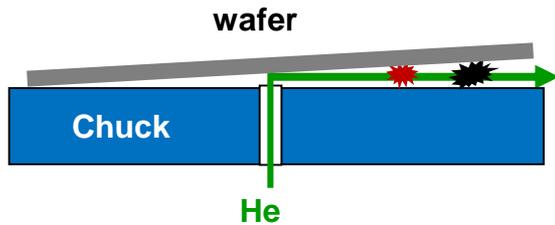
# Effect of CCW utilization (Etching : ③)



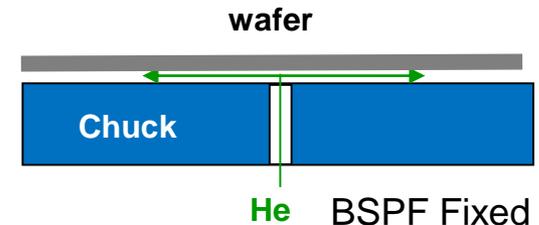
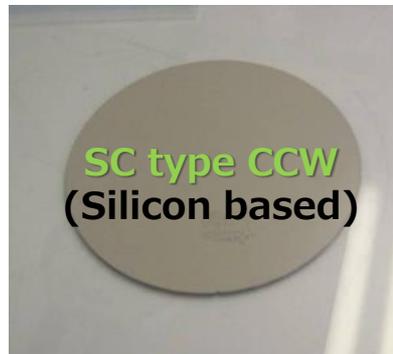
- 200mm LOGIC – Metal Etching
- CCW (Etch Clean) Recovery with 1 to 3 pouring, Dummy wafer - Recovery with 50 pouring = Shorter rise time / Operating time Up

# Effect of CCW utilization (Sputtering : ①)

It solves the problem of Helium leakage caused by dusts/particles on the chuck and contributes to improvement of yield. It also omits the extra wet cleaning process. Customers can head off the loss of dummy wafers to a minimum level after PM

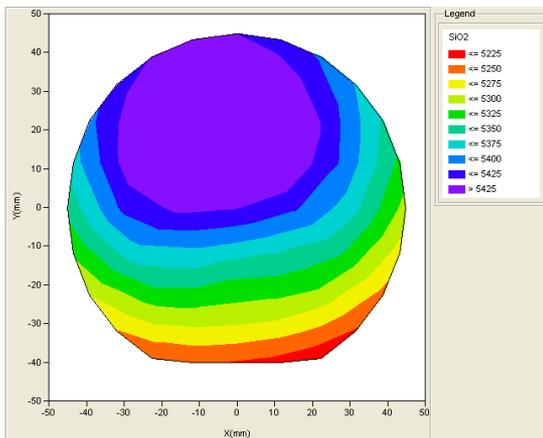


+



\* Because of the dust on the chuck, deposition uniformity > 5.2%

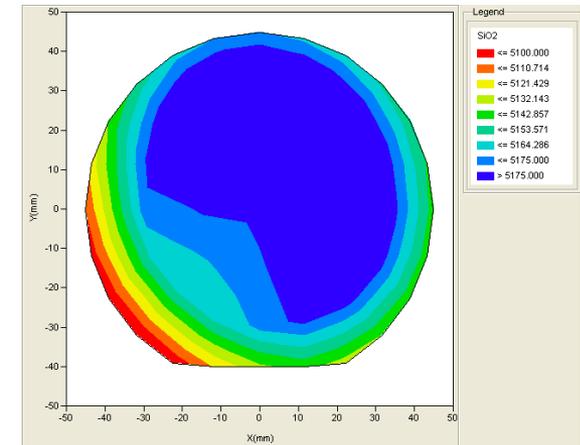
- \* Deposition uniformity < 2.5% by dust removal on the chuck by CCW
- \* Chamber opening not required



Surface SEM observation before and after cleaning



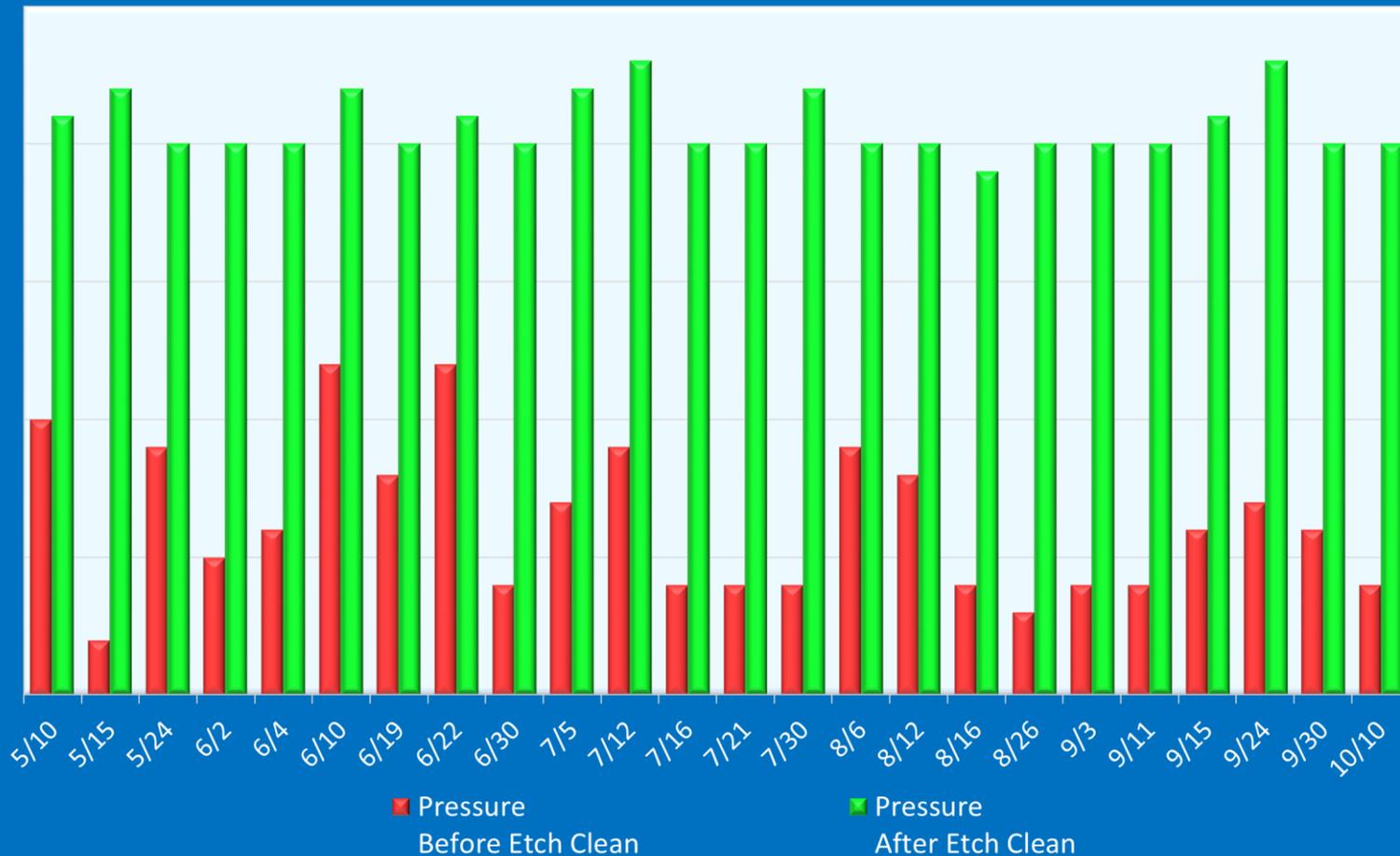
Remove alien matters without opening chamber



# Effect of CCW utilization

## (Sputtering : ②)

PVD - ESC Backside Pressure



# Summary

- \* The number of dummy wafers to be run after wet cleaning is greatly reduced. Reference: 50 wafers → 2 to 3 wafers
- \* **Photolithography** : It improves the problem of focus defect caused by hot spot by automatic conveyance.
- \* **Etching** : It improves the problem of Helium leakage error caused by dusts / particles on the chuck by automatic conveyance.
- \* **Sputtering** : It improves the problem of Helium leakage error caused by dusts / particles on the chuck by automatic conveyance. It also contributes to improving in-plane uniformity.
- \* As a result, customers can eliminate production loss due to equipment downtime occurred in each process.
- \* CCW can be reused by using in conjunction with PRF.  
CCW: 15 times use ➡ With PRF use : 100 times possible  
(Silicon type for etching and sputtering only)