

Clean Pad for Test Socket and Wafer Probe Cards

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Introduction

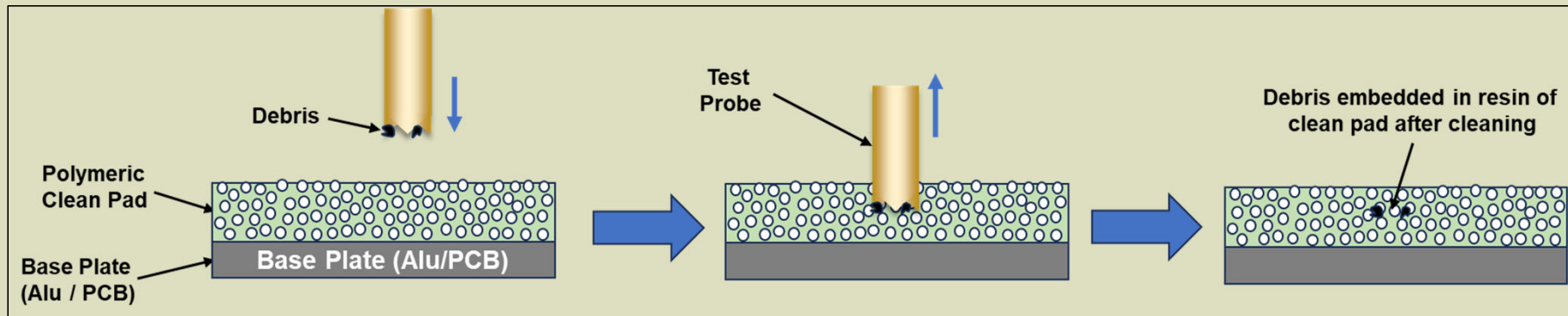
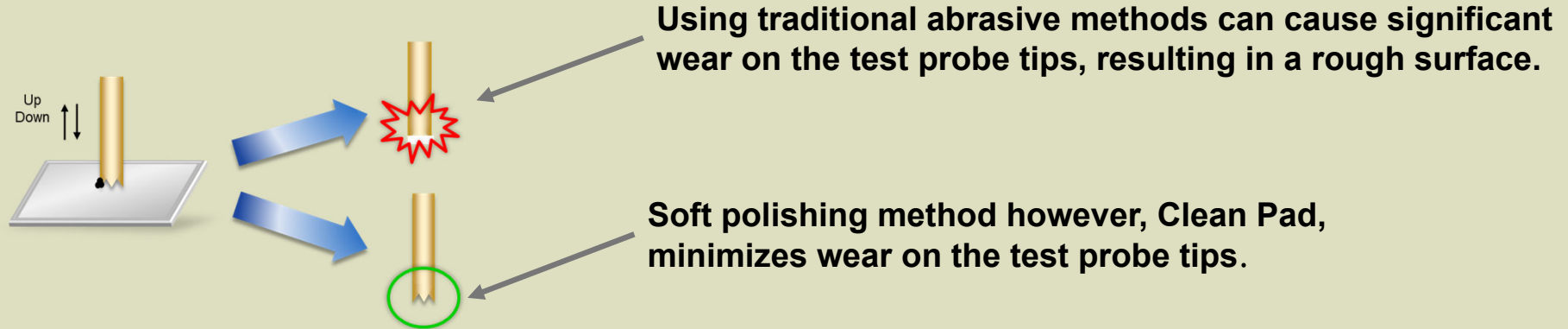
- Testing is a crucial process for determining the electrical and functional reliability of semiconductor devices at the wafer or chip level during manufacturing.
- Test Probe acts as the contact interface between the Device Under Test (DUT) and the tester, forming a connection for electrical and functional testing by making contact with the pads or bumps of the DUT. This contact interface is referred to as a "Test Socket" or "Wafer Probe Card."
- During testing, oxidation or residue can accumulate on the Test Probe, affecting electrical conductivity and leading to over-testing issues.
- Implementing a cleaning procedure during the testing process to minimize the accumulation of oxides or contaminants is essential for ensuring higher reliability.
- Existing cleaning methods include chemical, laser, or abrasive techniques.
- Cleaning can be performed offline or online.



Clean Pad for Test Socket and Wafer Probe Cards



Concept



Key Benefits

- Less wear on the test probe
- Lifespan of the Test Socket / Probe Card can be extended
- Frequency of Cleaning required can be reduced
- The First-pass yield can be maintained
- Uptime of the Testing equipment can be increased
- Operating costs can be reduced

Through these advantages, can significantly reduce hardware purchase costs and increase equipment uptime.

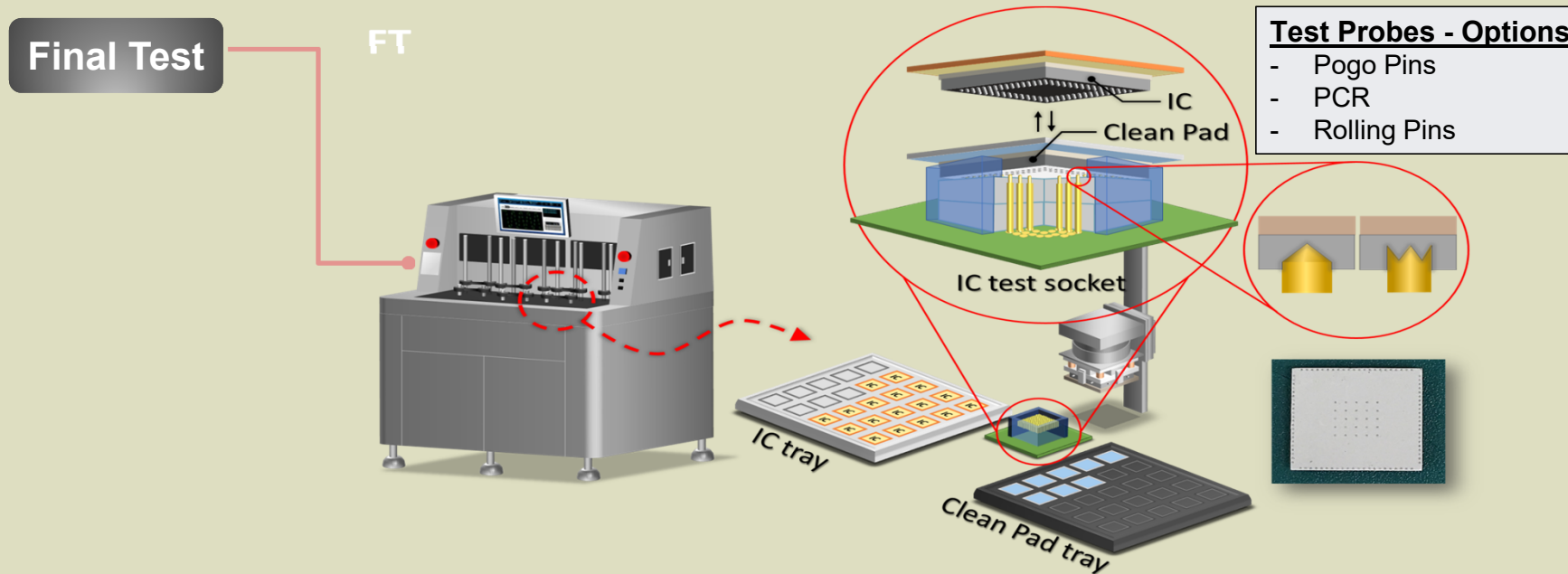


Clean Pad for Test Socket and Wafer Probe Cards



Key Benefits

- In semiconductor processing, the final IC package device must undergo electrical testing to classify it as pass/fail or based on performance criteria before being delivered to the customer.



Product Types : Final Test

Clean Pad For Test Socket

- ✓ **CF-900**
 - Applications: Final Test (FT) / System Level Test (SLT) / Burn-In Test
 - Used for cleaning pogo pins of point, crown, and Kelvin tip types.

- ✓ **CF-P85**
 - Applications: Final Test (FT) / System Level Test (SLT) / Burn-In Test
 - Used for cleaning Polymeric Conductor Rubber (PCR) sockets

- ✓ **CF-RSP**
 - Applications : Final Test (FT)
 - Used for Rolling stamped pins Socket cleaning

Specification

Specifications	Model : CF-900	Model : CF-P85	Model : CF-RSP
Test Process	Final Test (FT)	Final Test (FT)	Final Test (FT)
Recommended Probe Type	Crown / Point / Kelvin	PCR	Rolling/Rocking
Applications	QFN / BGA / QFP / SOP	QFN / BGA	BGA / QFN
Clean Particle Size	2um ~ 4um	2um ~ 4um	3um ~ 5um
Hardness	58 ~ 63	60 ~ 65	60 ~ 65
Thickness	428um ± 20	428um ± 20	0.65mm, 0.75mm, 0.8mm, 0.85mm, 1.0mm
Life Cycle	> 300	> 300	300 ~ 500
Wear Out (TD - 300 cycles)	< 3um	< 3um	NA
Clean Pattern	Up/Down (Vertical)	Up/Down (Vertical)	Scratch
OverDrive	30um ~ 80um (ref)	30um ~ 80um (ref)	NA
Operating Temperature	-40°C ~ 150°C	-40°C ~ 130°C	-40°C ~ 180°C

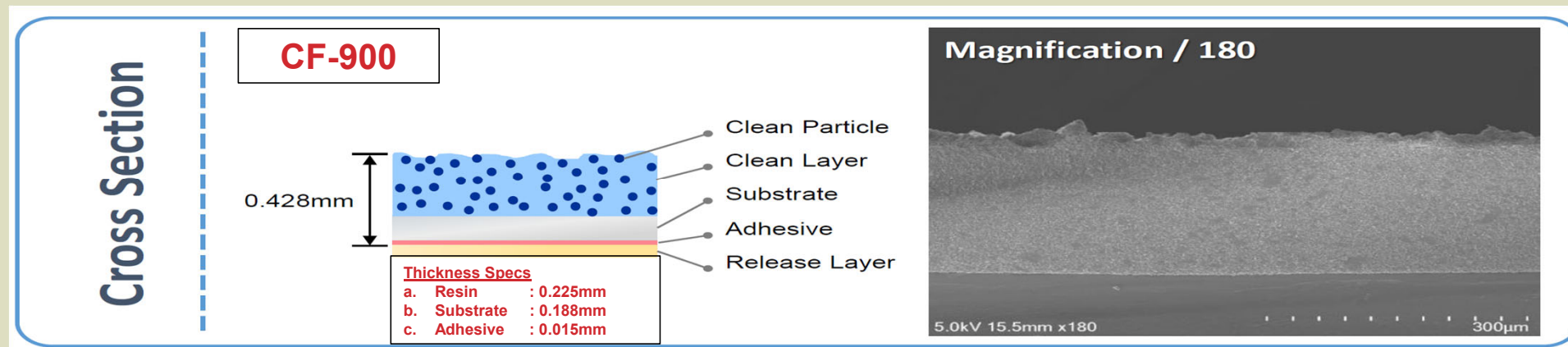


Clean Pad for Test Socket and Wafer Probe Cards



CF-900

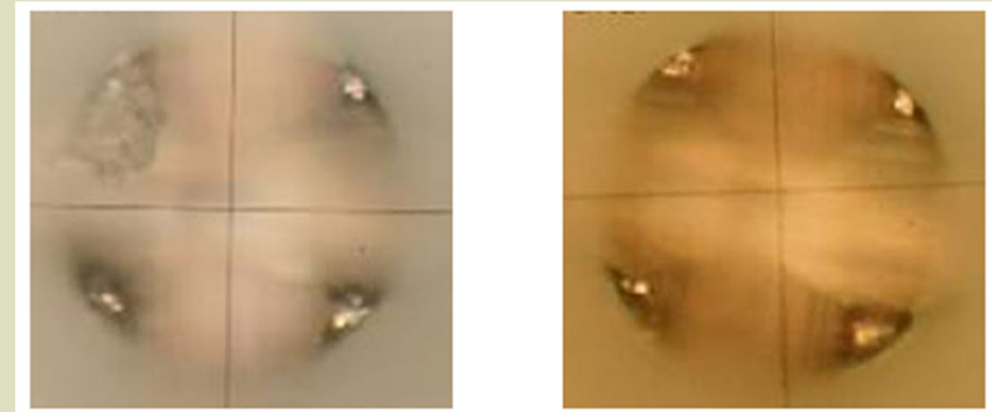
- In the final test, the probe tips of the test socket come into contact with the device contacts, causing particles and contaminants from the device contacts to adhere to the probe tips. This can result in noise or increased contact resistance, leading to excessive testing.
- It is important to use a reliable cleaning method to remove contaminants from the probe tips, as online cleaning reduces downtime and maximizes throughput.
- The CF-900 has been developed for cleaning test sockets to remove contaminants from the probes, thereby extending the lifespan of the socket and maintaining the shape of the tips.



CF-900 – DOE for Cleaning Effect

Design of Experiment

Description	Details
Probe Type	Crown Tip
Clean Pattern	Up / Down
Over Drive	100um
Cleaning Count	5 times
Cleaning Temperature	25°C



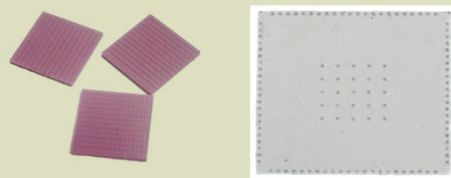
Before

After

CF-900 – Test #1 (QFN)

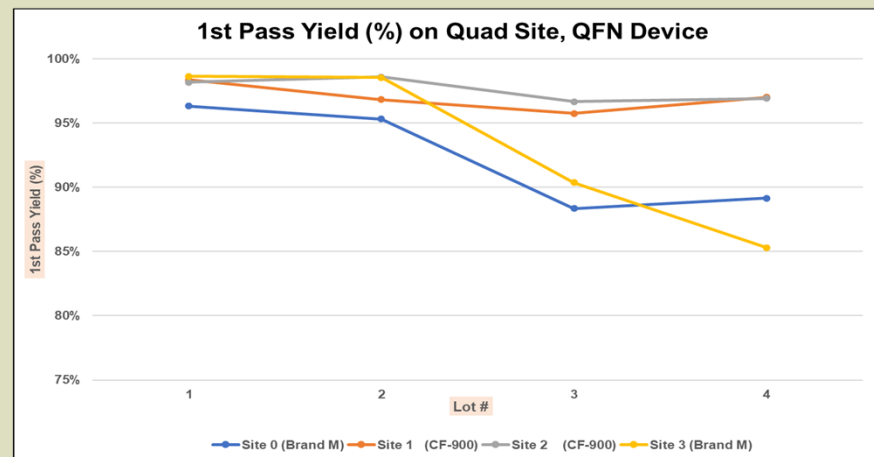
Test : CF-900 vs Brand “M”

- Quad site testing was conducted on 4 lots of QFN devices.
- Sites 0 and 3 used brand “M,” while sites 1 and 2 used CF-900.
- The yield for sites 1 and 2 using CF-900 was higher than that of brand “M.”



Brand “M” (blue arrow)
 CF-900 Clean Pad (red arrow)
 CF-900 Clean Pad (green arrow)
 Brand “M” (purple arrow)

Lot #	Site 0 (Brand M)	Site 1 (CF-900)	Site 2 (CF-900)	Site 3 (Brand M)	Time	Clean Interval
Lot #1	96.32%	98.38%	98.19%	98.65%	10:10	10/70
Lot #2	95.32%	96.83%	98.59%	98.56%	11:10	10/70
Lot #3	88.36%	95.76%	96.68%	90.38%	12:00	10/70
Lot #4	89.15%	97.01%	96.93%	85.31%	12:40	10/70

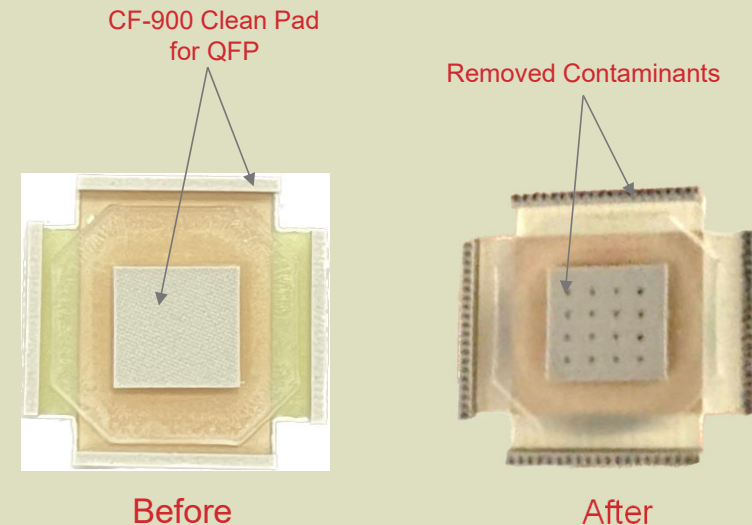


CF-900 – Test #2 (QFP)

Test : Offline vs Online Cleaning

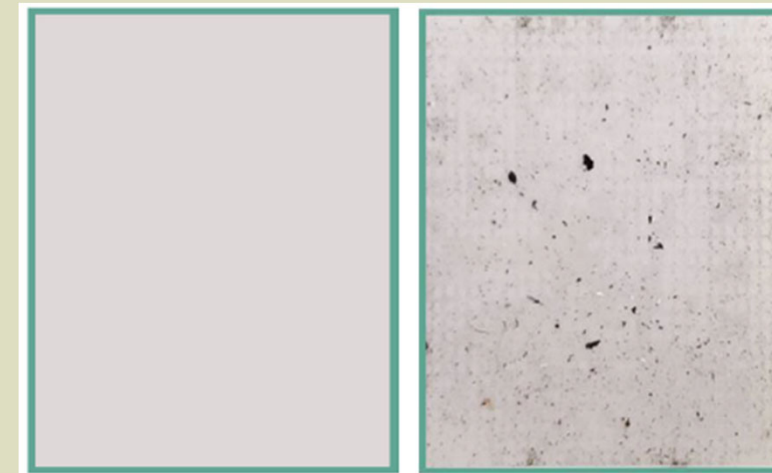
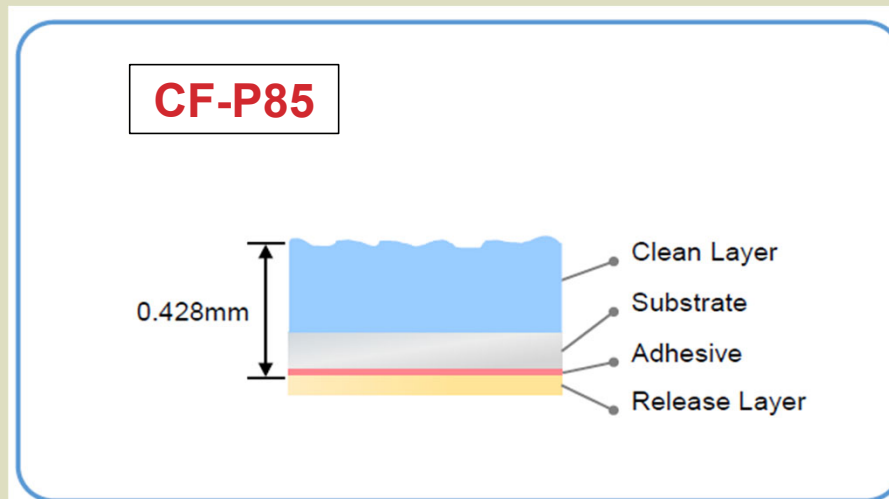
- The customer is currently performing offline cleaning
- When the yield drops to a "warning" level, they clean the socket using a brush or laser
- By using CF-900 for online cleaning, the yield improves and is maintained at production levels

DOE - No clean & Online auto-clean Comparison					
Clean Pattern			Up/Down (Vertical)		
Clean Interval			5 times for every 200 cycles		
# of Touchdown	Site 1	Site 2	Site 3	Site 4	AVG.
Manual online/offline cleaning					
0	93.03%	94.11%	93.57%	94.00%	93.67%
Auto online cleaning with Clean Pad based on clean interval					
25	98.11%	98.01%	98.56%	98.74%	98.36%
150	98.05%	97.30%	98.55%	98.02%	97.98%
300	96.91%	96.61%	97.07%	96.20%	96.70%



CP-P85

- Unlike pogo pin sockets, PCR sockets are made of polymer material that includes conductive columns, which are suitable for high frequency, low inductance, and advanced chip testing
- The layer of CF-P85 has unique 'viscoelastic properties' that can adhere and trap foreign substances and particles generated during probing, thereby extending the lifespan of PCR sockets



CF-RSP

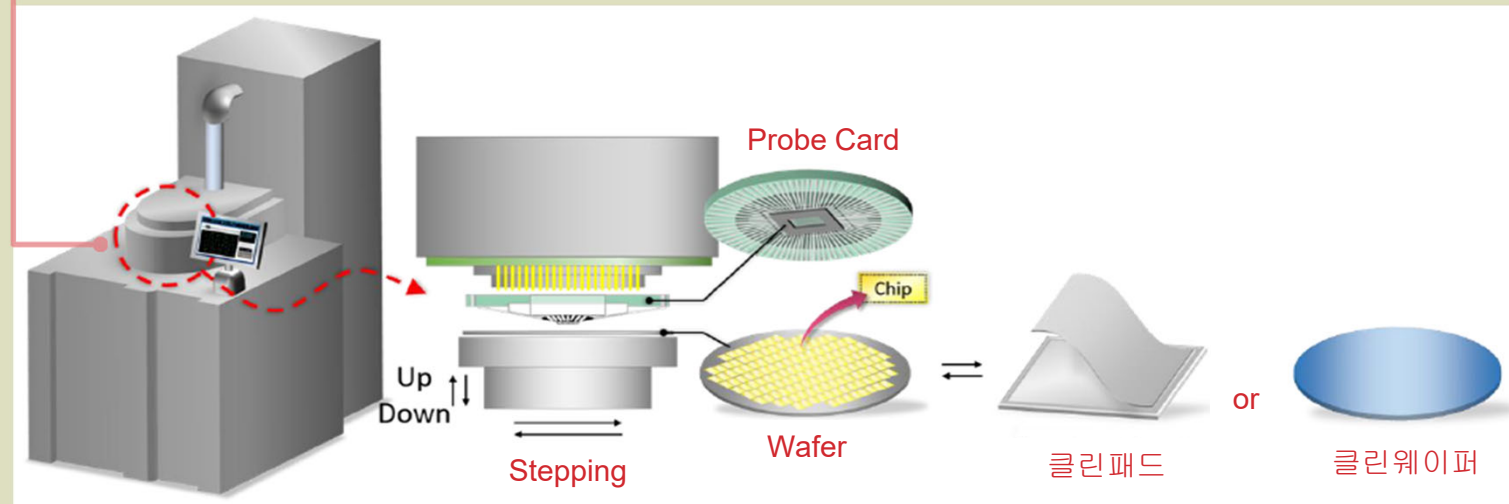
- CF-RSP is designed to remove foreign substances embedded in rolling pin-type test sockets
- Since it adheres to and traps foreign substances and particles generated during the probing process, the wear is not significant, thus extending the performance and lifespan of the socket.



Clean Pad : Chip Probing

In the semiconductor process, individual chips within a wafer must undergo electrical testing using probe cards to check their functionality and yield

Wafer Sort



Product Types : Chip Probing

Clean Pad for Chip Probing

- ✓ **CF-100**
 - Application : Chip Probing
 - Used for cleaning Point of Probe Card and Crown type Pogo pins

- ✓ **CF-500**
 - Application : Chip Probing
 - Used for cleaning Point of Probe Card and Crown type Pogo pins

- ✓ **CF-801**
 - Application : Chip Probing
 - Used for cleaning Point of Probe Card and Crown type Pogo pins

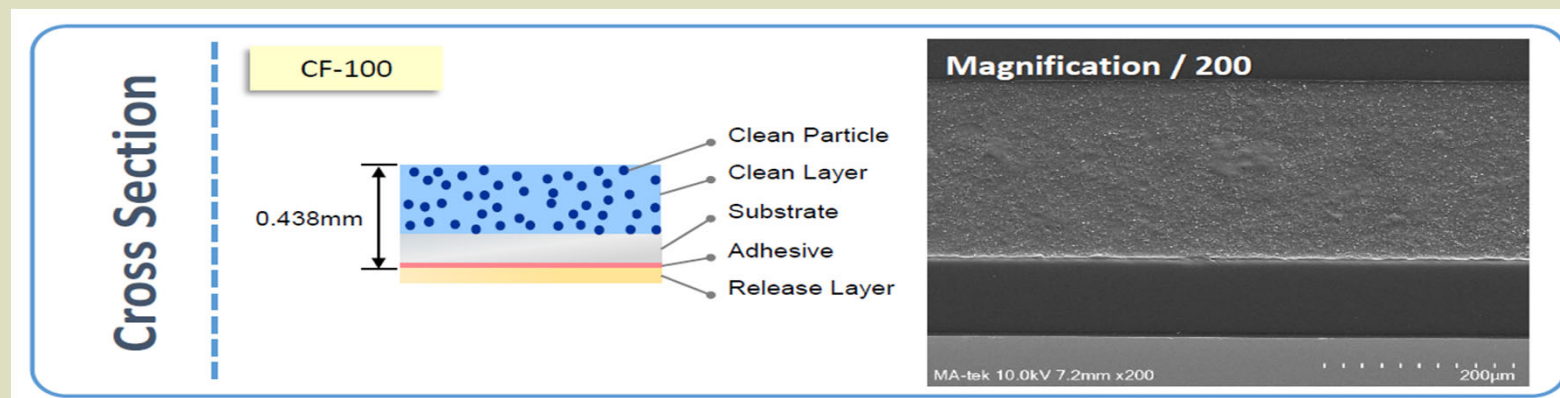
- ✓ **CF-W01**
 - Application : Chip Probing
 - Probe Card Type : MEMs Micro-Cantilever
 - Probe Pin Type : Pyramid Pin, “U” or “V” Tip

Specifications

Specifications	Model : CF-100	Model : CF-500	Model : CF-801	Model : CF-W01
Recommended Probe Card Type	Vertical Probe Card	Vertical Probe Card	Vertical Probe Card	MEMs Micro-Cantilever
Recommended Probe Tip	Crown, Point	Crown, Point	Crown, Point	Pyramid, "U" or "V" probe
Application Type	General	General	General	Memory
Thickness	438um ± 20	450um ± 100	375um ± 20	1005um ± 40
Clean Particle Size	1um ~ 3um	2um ~ 4um	0.5um ~ 2um	1um ~ 3um
Hardness (Shore A)	65 ~ 70	74 ~ 79	62 ~ 67	71 ~ 76
Wear Out (TD 20K)	< 5um	< 8um	< 1um	< 1um
Clean Pattern	Up/Down	Up/Down	Up/Down	Up/Down
Over Drive	Full Contact (30um~80um)	Full Contact (30um~80um)	Full Contact (30um~80um)	Full Contact (50um~140um)
Life Cycle				> 300
Operating Temperature	-40°C ~ 150°C	-40°C ~ 130°C	-40°C ~ 200°C	-40°C ~ 150°C

CF-100

- Due to continuous electrical testing of wafer chips, contaminants accumulate on the test probe tips, leading to increased contact resistance, which can result in incorrect test results and affect yield.
- To enhance production efficiency, an effective and easy online cleaning method is needed for cleaning the test probes.
- The CF-100 clean pad has been developed to remove foreign substances and contaminants from test probes, thereby extending the lifespan of probe cards.



CF-100 : Test #2

- To ensure accurate data collection, wafer testing was conducted using 26 sets of wafer probers across 8 device types.
- Overall Equipment Efficiency (OEE) has increased.

Overall Equipment Effectiveness (OEE)

Device	Production	Pin Type	Existing Pad Type (%)	New Pad Type (%)	Difference (%)	Chart
A	1	Pogo	77.78%	87.63%	9.85%	
B	5	Pogo	66.68%	71.39%	4.71%	
C	8	Pogo	90.94%	91.87%	0.93%	
D	4	Pogo	80.89%	85.15%	4.26%	
E	2	Pogo	83.29%	89.37%	6.08%	
F	1	Pogo	59.84%	63.40%	3.56%	
G	3	Pogo	72.50%	75.50%	3.00%	
H	2	Pogo	55.78%	58.10%	2.32%	

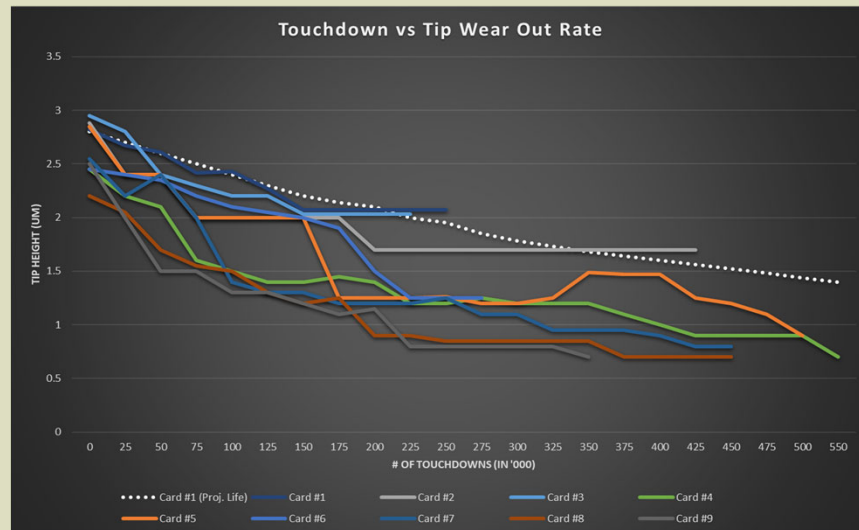
CF-100 : Test #2

- To ensure accurate data collection, wafer testing was conducted using 26 sets of wafer probers across 8 device types
- The first pass yield was maintained at a level similar to that of Brand M clean sheets
- The lifespan of the probe cards has been extended until repair and replacement (improvement in MTBF)
- The lifespan of the clean pads has shown to be longer than that of competitors' products

1 st Pass Yield						
Device	Production	Pin Type	Existing Pad Type (%)	New Pad Type (%)	Difference (%)	Chart
A	1	Pogo	99.60%	99.63%	0.03%	
B	5	Pogo	99.15%	99.12%	-0.03%	
C	8	Pogo	98.03%	98.33%	0.30%	
D	4	Pogo	98.92%	98.69%	-0.23%	
E	2	Pogo	99.24%	99.21%	-0.03%	
F	1	Pogo	98.29%	98.15%	-0.14%	
G	3	Pogo	99.16%	99.10%	-0.06%	
H	2	Pogo	99.57%	99.63%	0.06%	

CF-100 : Test #3

- To verify the performance of CF-100 and brand "M," various wafer probe cards were used
- Probe Card #1 utilized CF-100 from the beginning of online cleaning
- Probe Cards #2 and #3 initially used brand "M" for cleaning but switched to CF-100 at the 100K cycle mark.
- All other cards were cleaned using brand "M."



Result :

Wear of tip length using CF-100 was significantly less than when using brand 'M' throughout the entire cleaning process

Even at 550K cycles, all three probe cards using CF-100 had tip lengths greater than 1.5µm

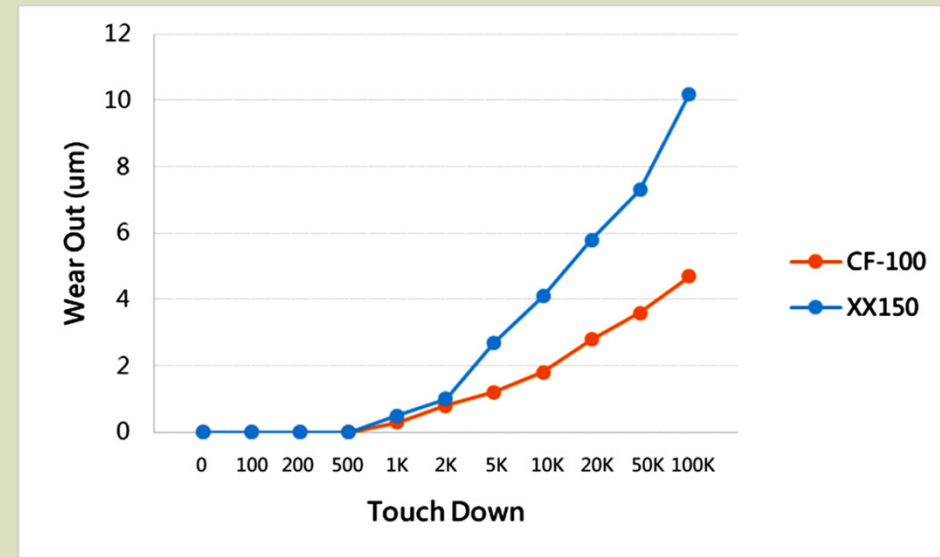
For Probe Card #1, which used CF-100 from the beginning, the results showed much less wear compared to other tips at 550K cycles."

CF-100 – DOE for Wear-Out Rate

- Test was conducted directly by the customer to compare the wear rate of probe tips between touchdown (TD) intervals by measuring the differences in tip depth.

Design of Experiment

Description	Details
Probe Type	Crown Tip
Probe Diameter	65um
Clean Pattern	Up / Down
Over Drive	80um
Cleaning Temperature	25°C

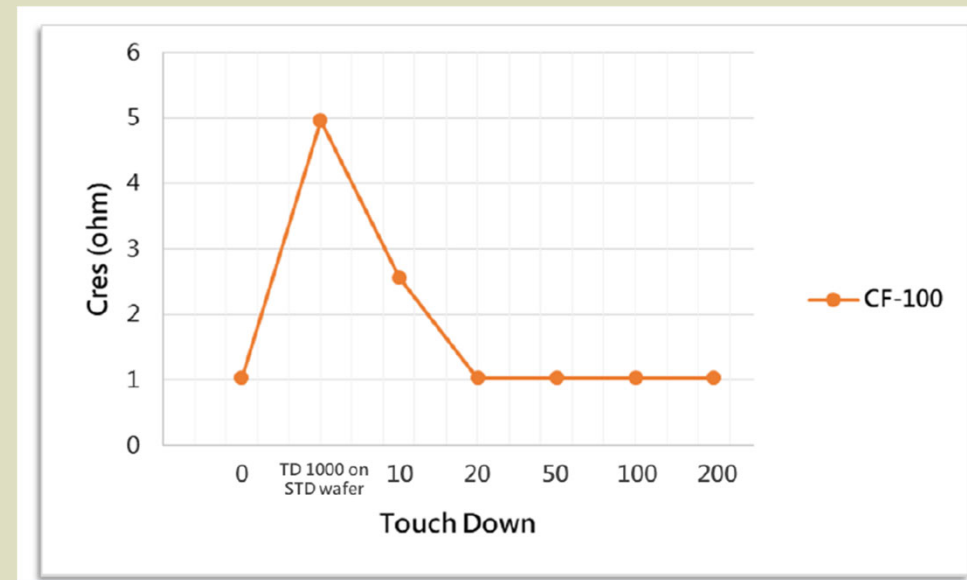


CF-100 – DOE for Contact Resistance

- Test was conducted directly by the customer to measure the contact resistance before and after cleaning with CF-100

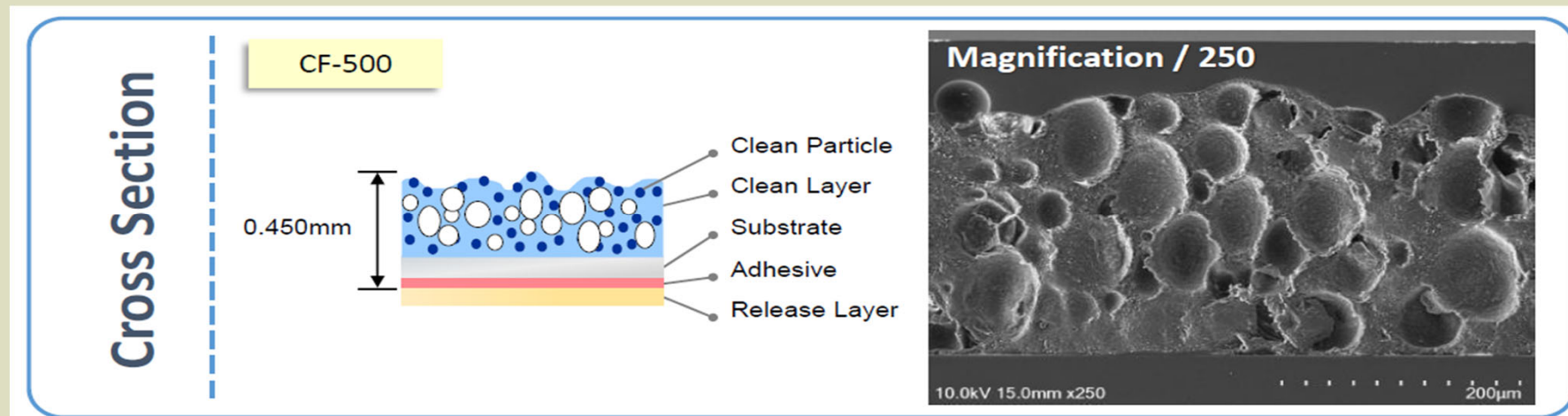
Design of Experiment

Description	Details
Probe Type	Crown Tip
Probe Diameter	65um
Test Target	Sn Bump
Clean Pattern	Up / Down
Over Drive	80um
Clean Temperature	150°C



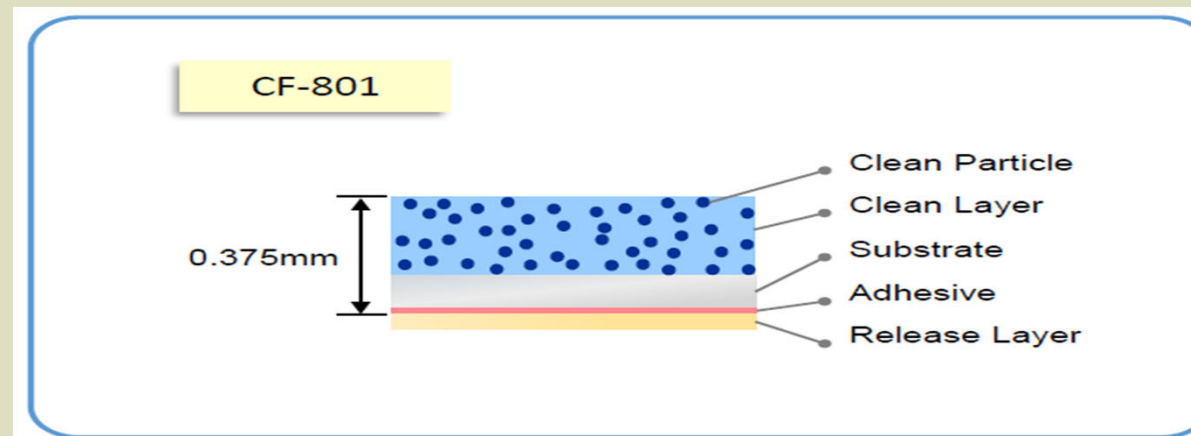
CF-500

- During electrical testing, metal probes come into contact with chip pads, and oxides can easily form on the pad surface, contaminating the metal probe tips with foreign substances
- This can lead to excessive testing in electrical tests, affecting yield
- The cushioned structure and special cleaning resin material of the CF-500 clean pad effectively clean the probes without deforming the probe tips



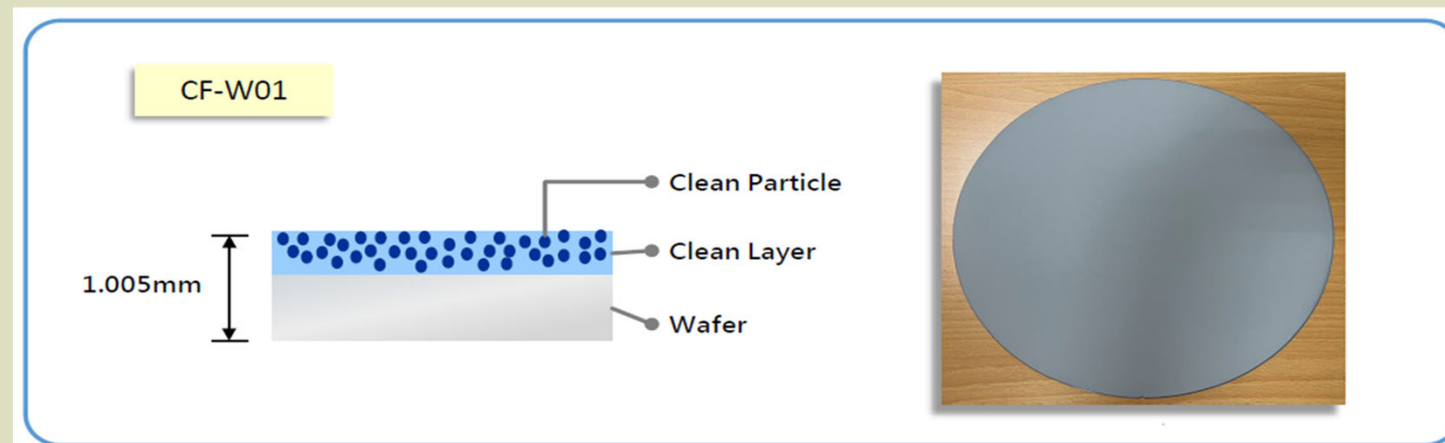
CF-801

- With the growth of 5G infrastructure, the rapid advancement of AI, and the proliferation of electric vehicles, the demand for semiconductor chips continues to rise, significantly increasing the importance of wafer testing
- CF-801 has been developed to remove foreign substances and contaminants from test probe tips
- Its special cleaning layer, resin layer, and adhesive components can withstand temperatures of up to 200°C



CF-W01

- MEMS probe cards represent the most advanced technology currently available, and each metal probe possesses buckling characteristics that can meet the requirements for flatness and contact pressure necessary for 12" wafers, making them easier to control than traditional probe cards
- CF-W01 has been developed to remove foreign substances and contaminants from test probes, thereby extending the lifespan of memory device probe cards



CF-W01 – DOE for Cleaning Effect

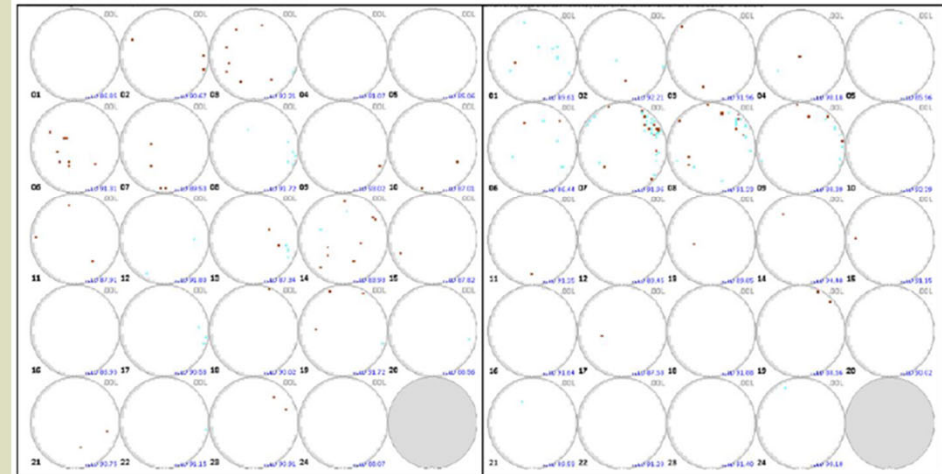
- The customer tested CF-W01 and brand "I" using the same cleaning parameters
- In the overall evaluation, CF-W01 showed a yield that was 1% higher than that of brand "I."

Design of Experiment

Description	Details
Probe Type	MEMs Micro Cantilever
Clean Pattern	Up / Down
Over Drive	140um
Cleaning Frequency	Every 5 wafers / Clean 50 times
Cleaning Temperature	125°C

"I" Company
Yield : 89.4%

CF-W01
Yield : 90.4%



Summary

- 테스트 과정에서 프로브에는 오염물이 지속적으로 쌓이고, 이로 인해 테스트결과에 영향을 미치게 됩니다.
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