Nissin Low-pressure Microwave Plasma System

Confidential information

Nissin Inc. Japan

-Outline-

- Company profile
- Plasma process
- Plasma application
- Plasma equipment

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Company Profile

Confidential information

Name: Nissin Inc. (*http://www.nissin-inc.co.jp*)

Establish: May/1947

Location: H.Q.

Takarazuka, Hyogo-pref. Japan

Yokohama sales center

Yokohama, Kanagawa pref. Japan

Yokohama R&D center

Yokohama, Kanagawa pref. Japan

Capital stock: 99,000,000 (JPY)

Employment: 200

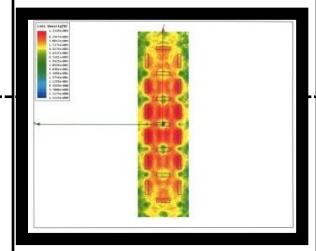
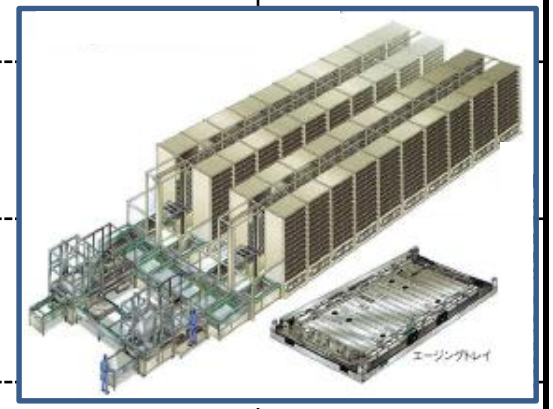
Plasma business: R&D, design, manufacturing, and sales of plasma system

Main customers of plasma business:

Major package companies (Flip-chip, HDI, CSP)、

Major PCB maker, Major FPC maker, Automotive etc.

Product history

Year	Microwave power source	Microwave Plasma R&D	Plasma measurent, diagnostics	Plasma process R&D	Mechatronics
1985	半導体メーカー向け OEM開発・供給開始 				
1990	Start sales for plasma usage 1.5kW,3kW,6kW	Start R&D of plasma			
1995		Develop plasma System for experiment	Develop plasma density Measurement method		Start sales PDP aging system
2000	Start sales for heating 6kW		Start sales of Plasma density measurement probe	Establish R&D Center for plasma research	
2005					

Enter plasma equipment market

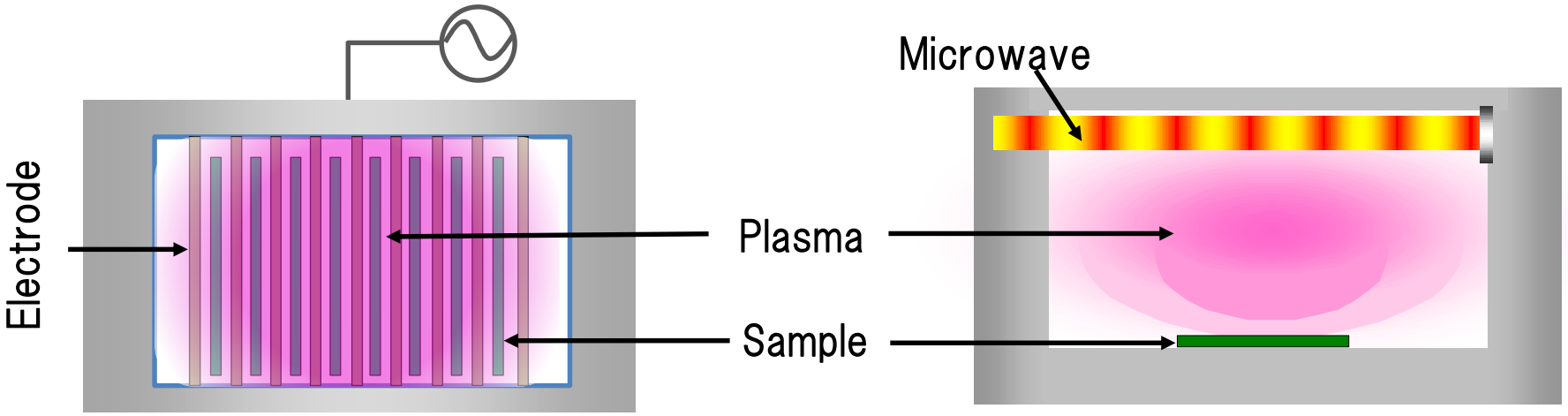
Sales reord: more than 100systems

Process application: PCB, Packaging, surface modification, resist stripping, reduction, improve adhesion

Technology Overview

- Low Pressure Microwave Plasma Equipment
- High power plasma compared with RF plasma
- Excellent processing uniformity
- Low temp. process compared with RF plasma
- Available full automation system

Comparison of RF and Microwave Plasma

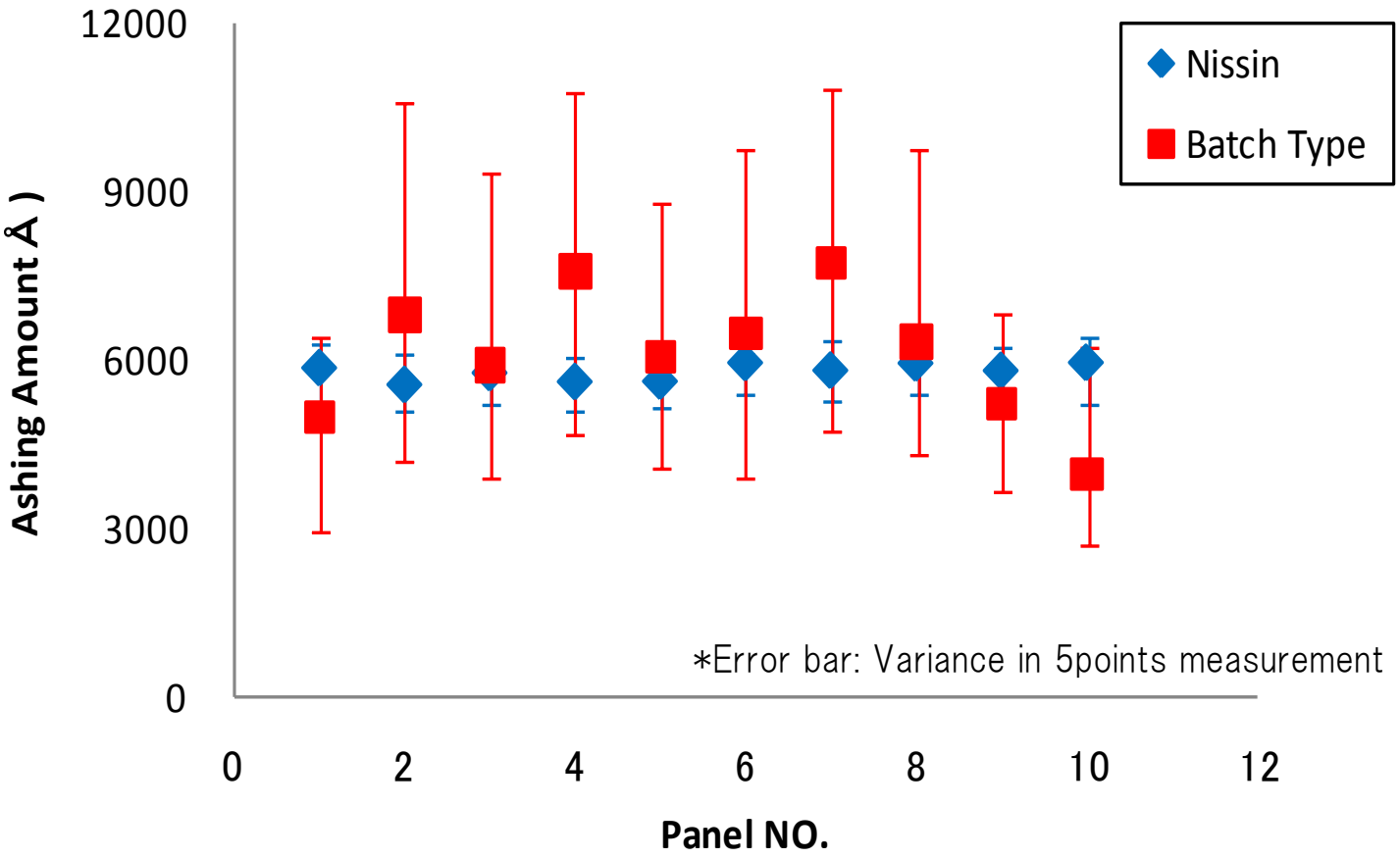


Batch-type RF plasma

Wafer-level microwave plasma

RF 13.56MHz	Source frequency	Microwave 2450MHz
About $10^9/cm^3$	Electron density	About $10^{12}/cm^3$
About 180℃	Processing temperature	Less than 90℃
High	Static damage	Low
Batch-type→Hard to automation In-plasma processing→High damage Plasma with electrodes→Low uniformity	Feature	Scanning process→High uniformity Remote plasma processing→Low damage Wafer-level processing→Easy to automation

Uniformity of Resist Stripping Rate



Uniformity of conventional RF plasma ≧±50%

Uniformity Nissin microwave plasma ≦±20%

Application: Organic material Etching (Etching rate)

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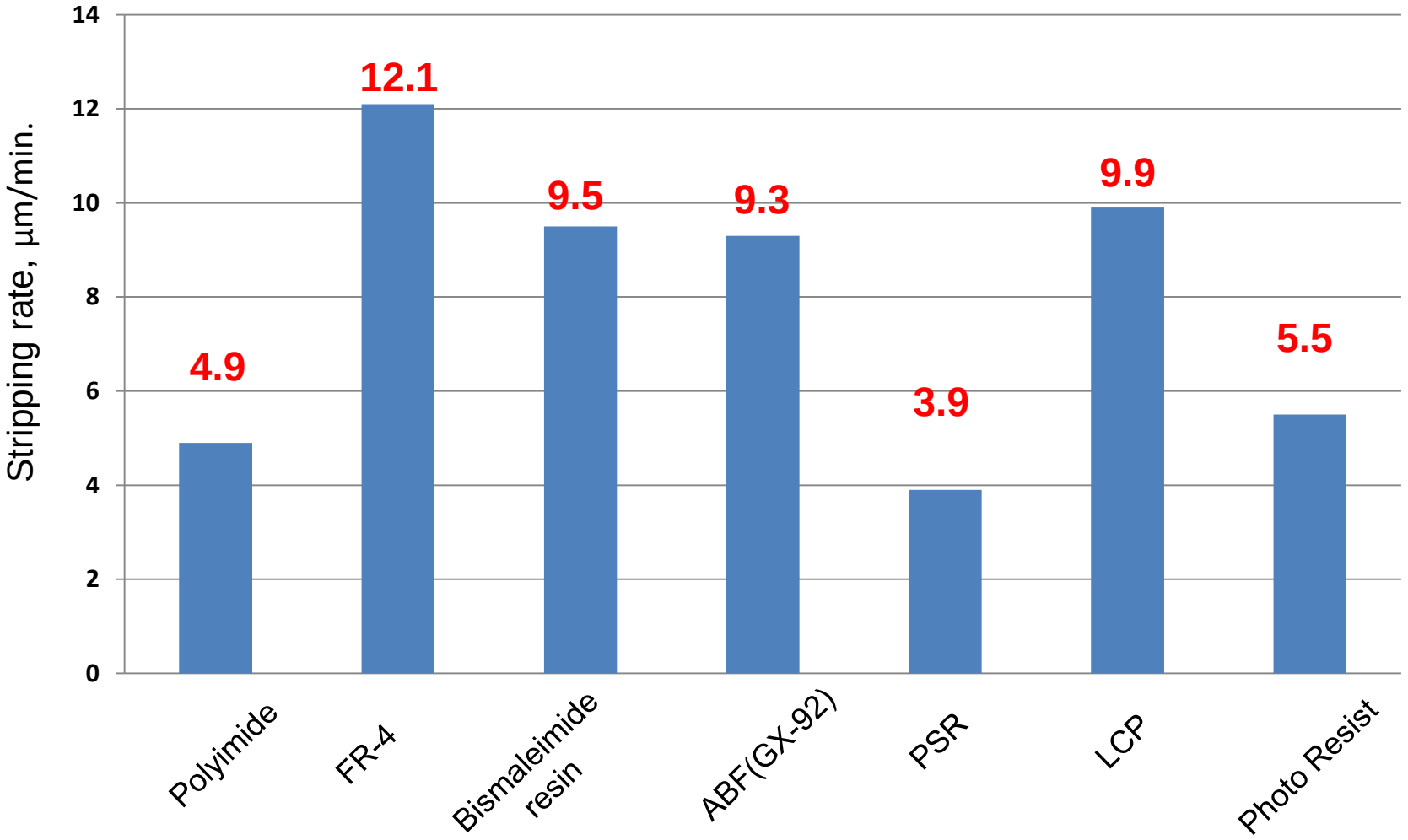
Nissin Plasma Technology

Realizes high-speed stripping rate for organic materials by applying microwave plasma. Its stripping rate is about 20 times larger than that of RF plasma.



Nissin Plasma Technologies

Application: Improve Wettability (Contact Angle)

Nissin Plasma Technology

Nissin plasma can improve surface wettability of various materials with short plasma treatment time

Result

Contact angle measurement before and after 3sec. plasma treatment

	Before	After
PI	64°	5°
FR-4	78°	6°
SR	71°	11°
LCP	89°	12°
PMMA	81°	17°
PET	81°	5°
PS	82°	5°
Cu	84°	5°
SiO_2	22°	5°

Application: Improve Peel Strength

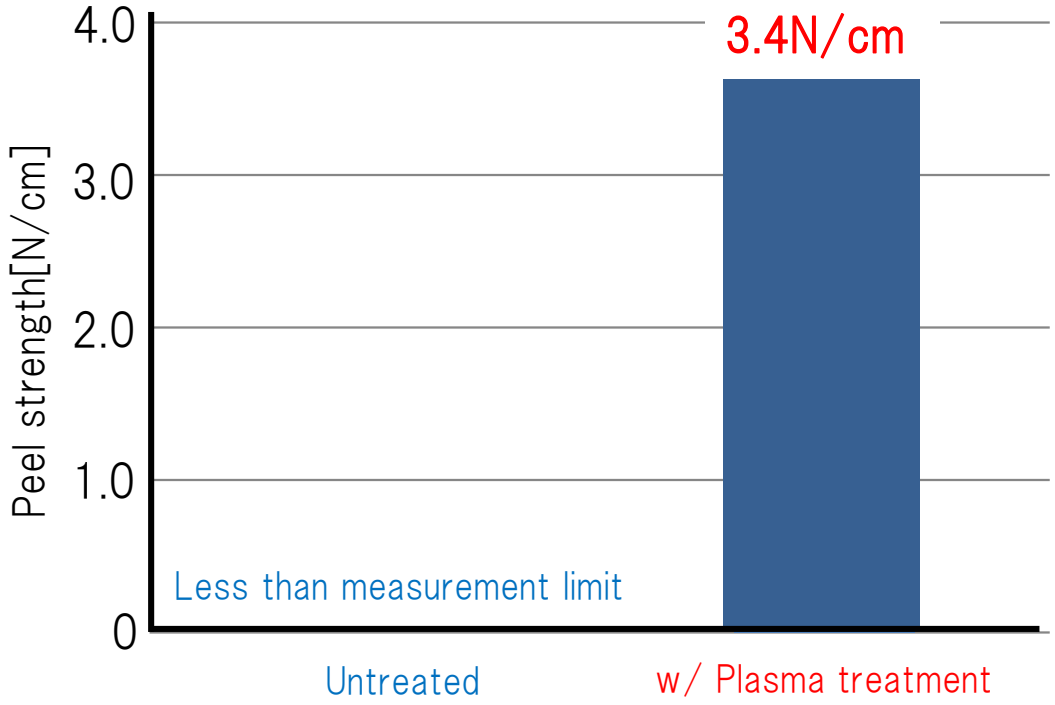
Application

Improve peel strength for the materials which has low surface profile, low surface energy, or hydrophobic.

Application example

Process: improve peel strength between **electroless Cu plating** and **PTFE**
Treatment time: 10sec.
Measurement: 180degree peel test

Result



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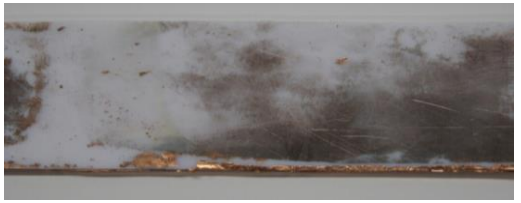
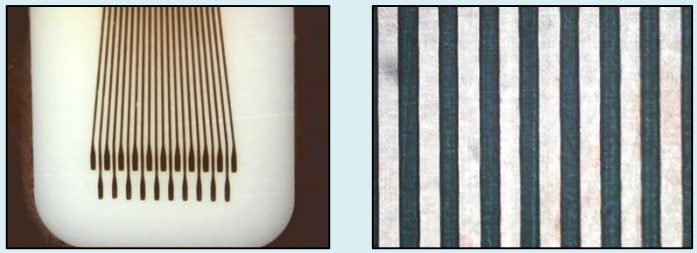


Treated: OK

Patterning on PTFE; L/S=50/50μm



Application: Improve adhesion Strength

Application

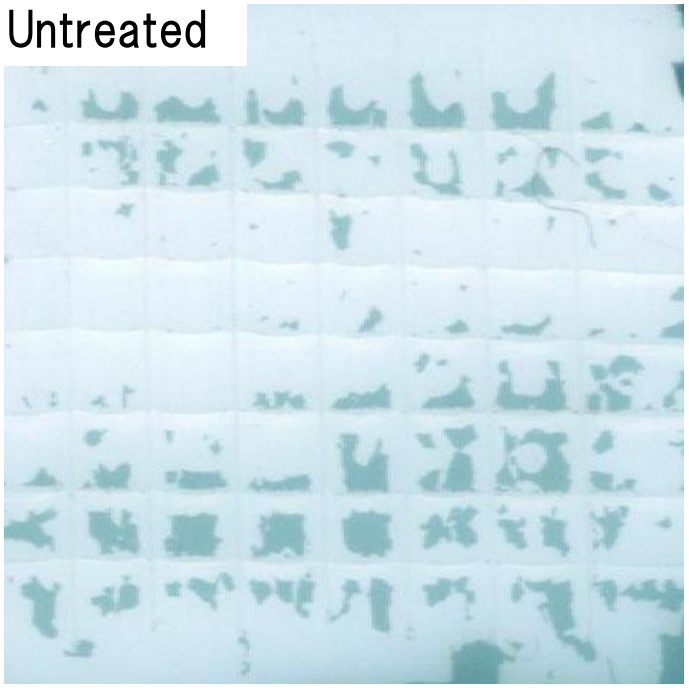
Improve adhesion strength for the materials which has low surface profile, low surface energy, or hydrophobic.

Application example

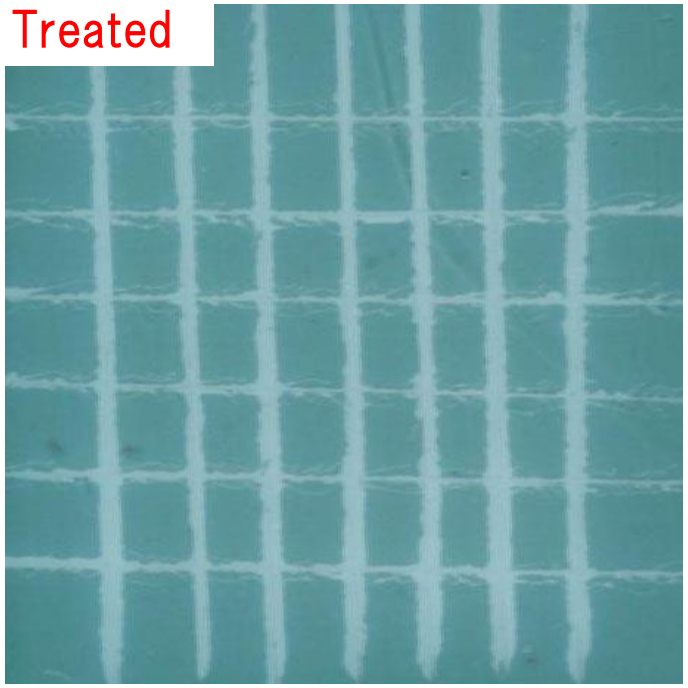
Process: improve peel strength between **liquid photo resist** and **PTFE**
Treatment time: 10sec.
Measurement: Cross-cut test checkerboard 1mm^2

Result

Untreated

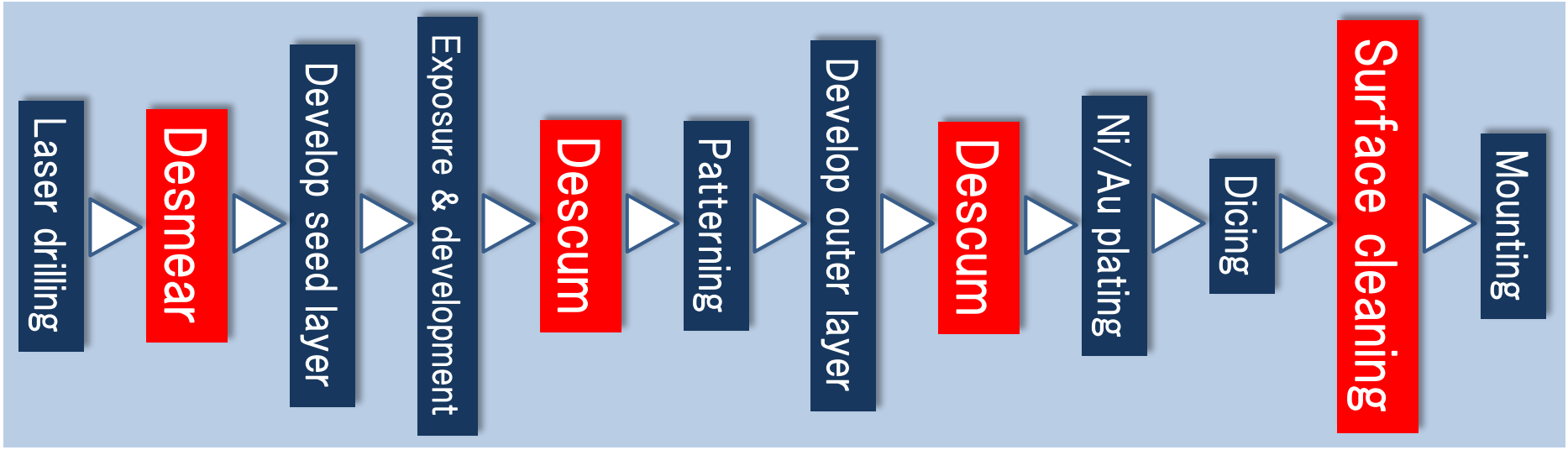


Treated



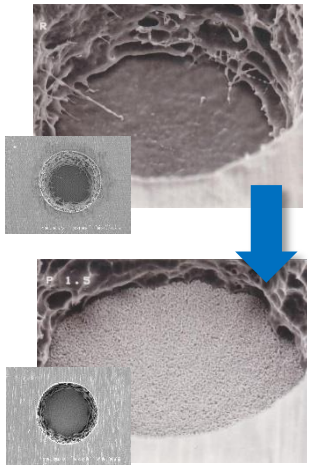
Plasma application for PCB and packaging

PCB application



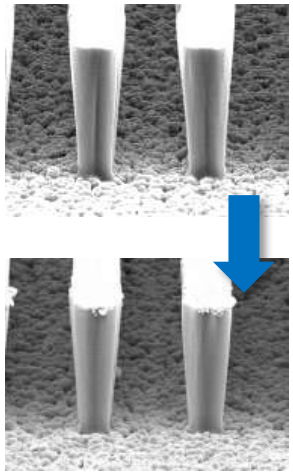
Dry desmear

- Micro via
- High-aspect
- Hydrophobic materials



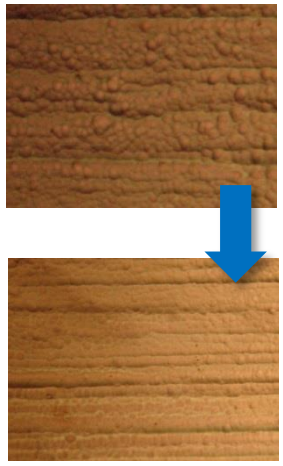
Fine-pitch patterning

- SAP
- M-SAP



Descum (before Ni/Au)

- Organic residue
- SR surface modification
  →Control UF wattability



Pad cleaning

- Remove oxidized layer
- Control weld wettability

Nissin Plasma Technologies; Desmear

Application

Dry desmear(remove smear after laser drilling process)

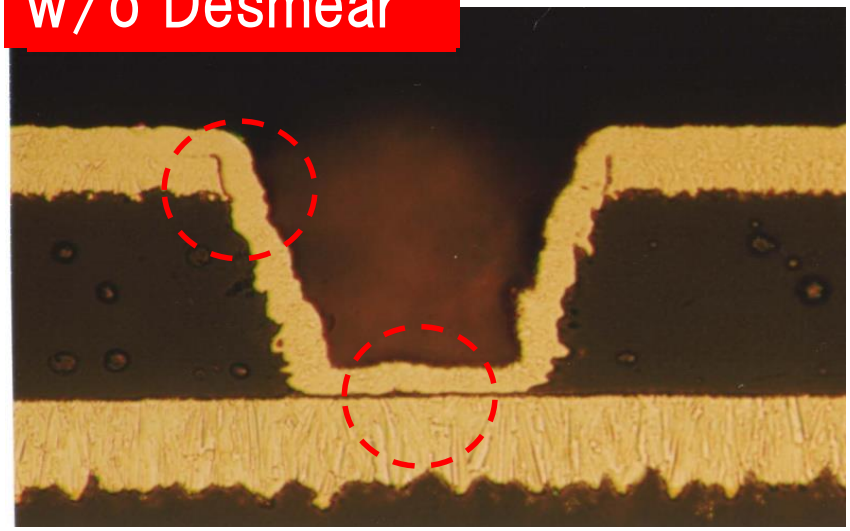
Application example

Process: Desmear for BVH(ϕ=100μ)

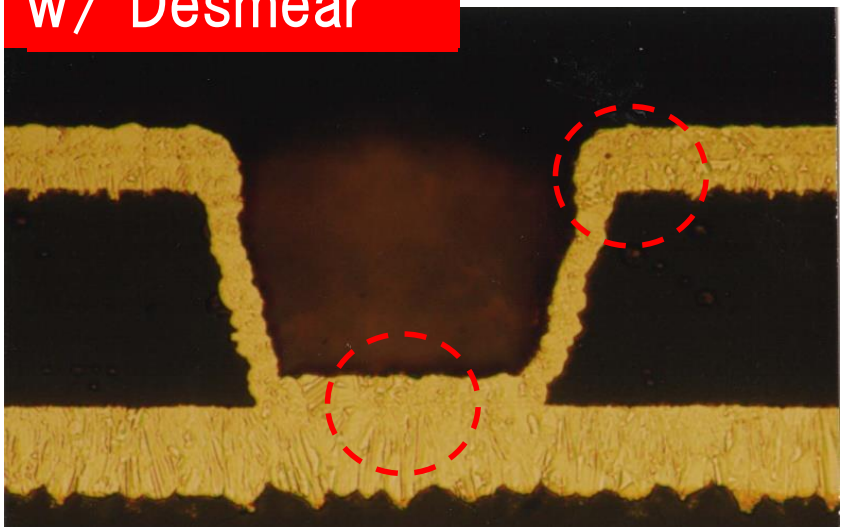
Measurement: Cross-section after Cu plating

Result

w/o Desmear



w/ Desmear



Nissin Plasma Technologies; Desmear

Application

Dry desmear(remove smear after laser drilling process)

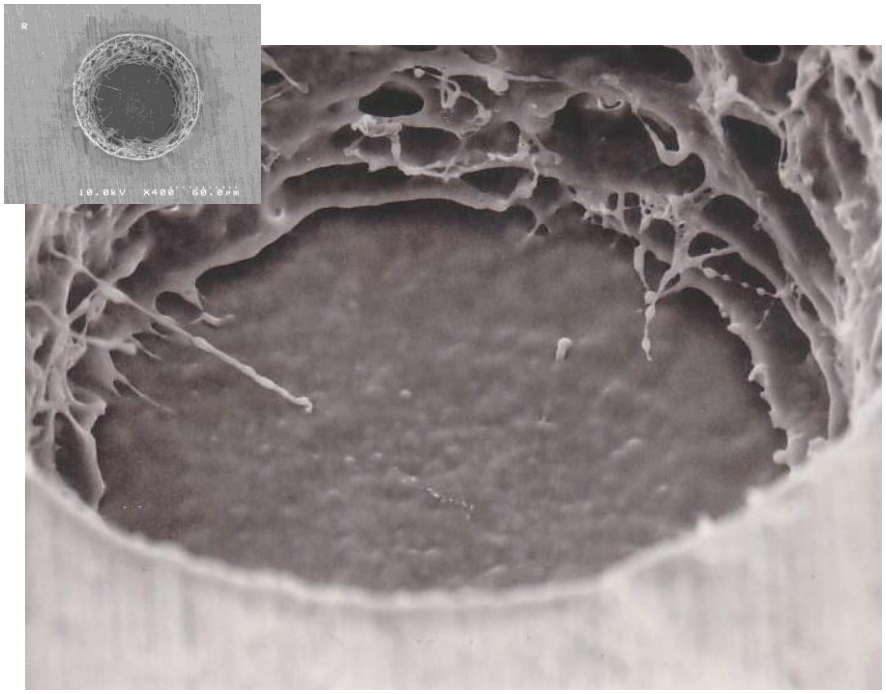
Application example

Process: Desmear for BVH(ϕ=100μ)

Measurement: SEM

Result

Untreated



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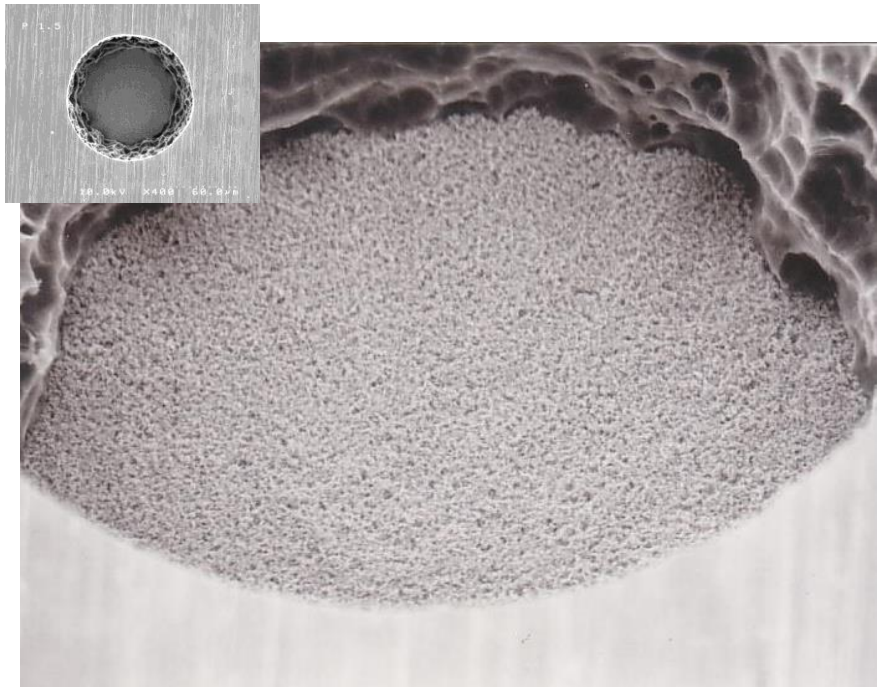


Nissin Plasma Technologies; Desmear

Application

Dry desmear for FPC(remove smear after laser drilling process)

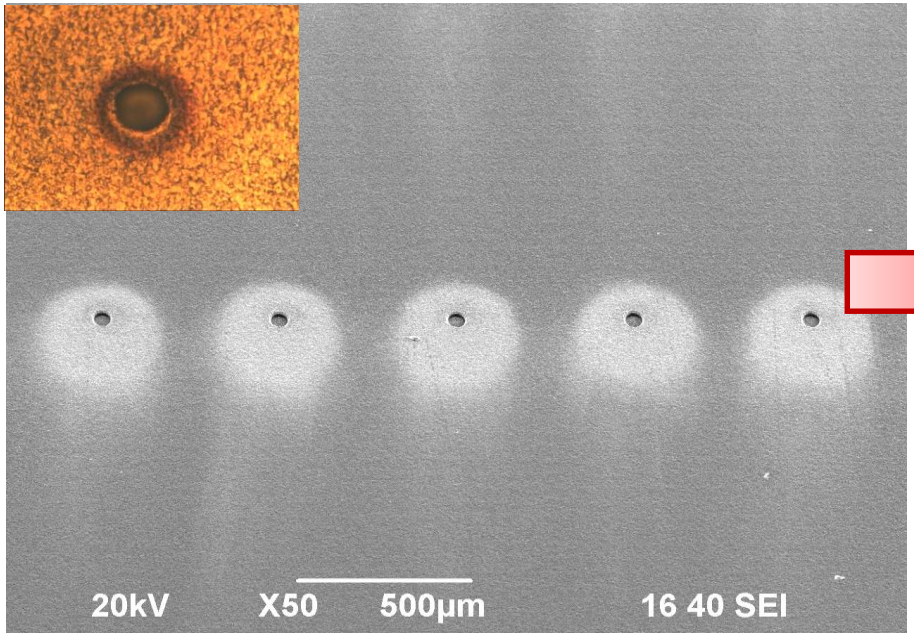
Application example

Process: Desmear for BVH(ϕ=50μ, Thickness of PI=25μ, Cu=12μ)

Measurement: Microscope

Result

Untreated



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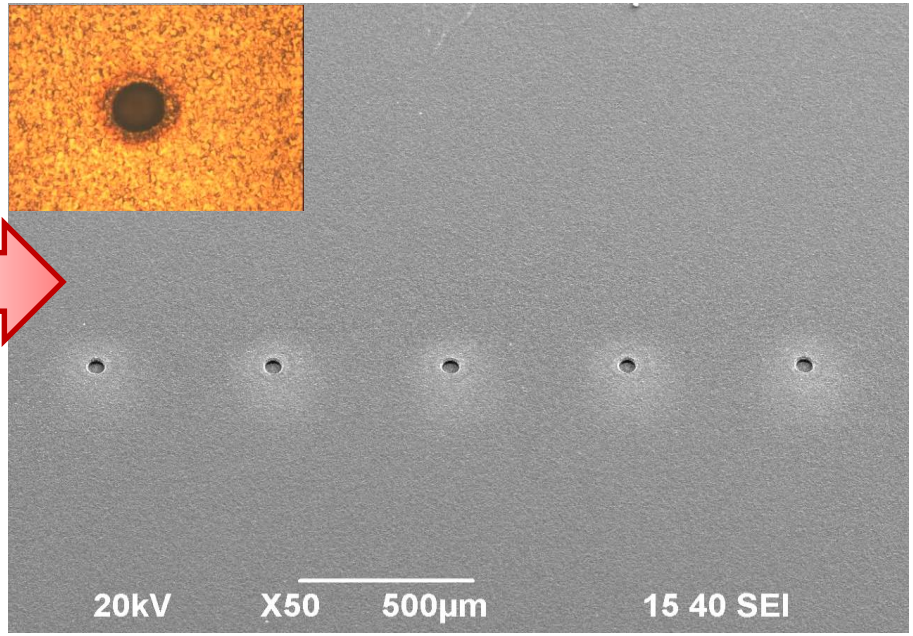
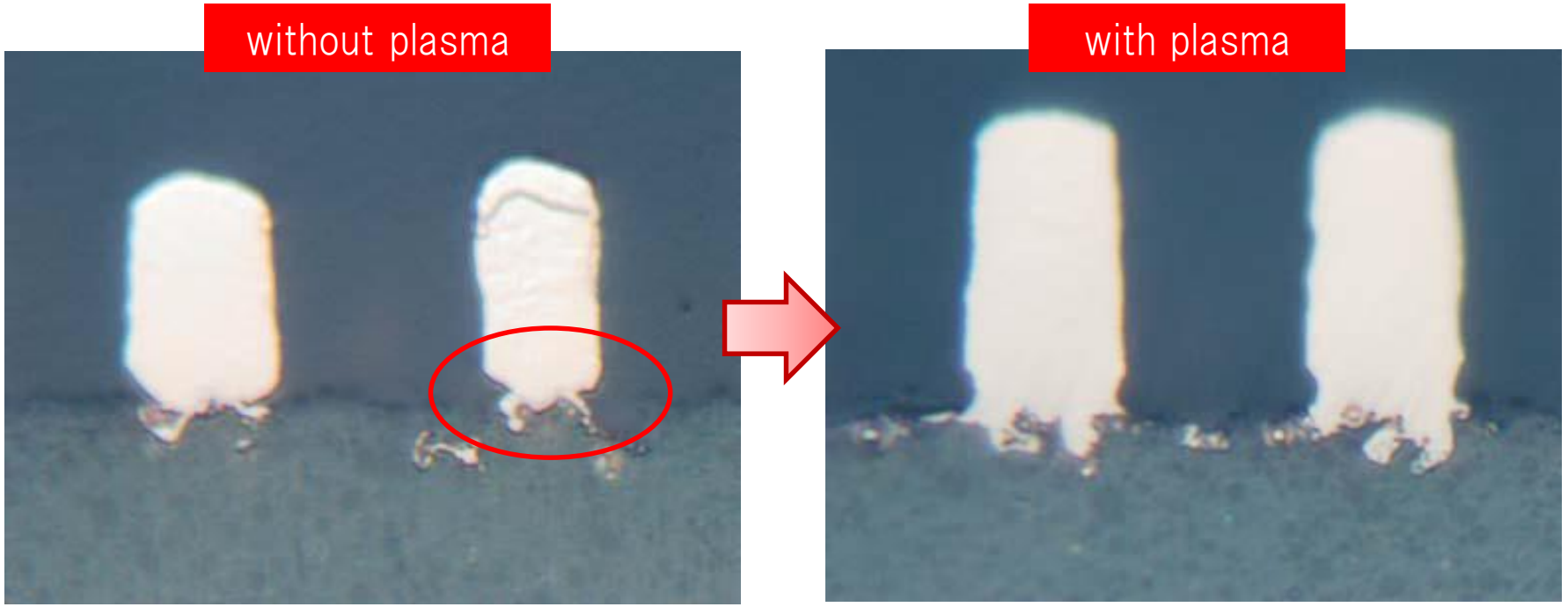


Nissin Plasma Technologies; Descum (SAP)

Application

Remove residue from the bottom of DFR pattern (×2500 SEM)

L/S : 9/12μm
Resist Thickness : 25μm



Nissin Plasma Technologies; Descum (SAP)

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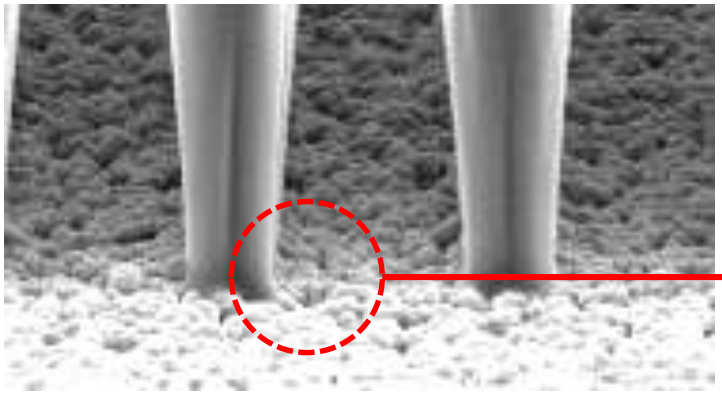
Application

Remove residue from the bottom of DFR pattern L/S=10/10μ (×2500 SEM)

Untreated



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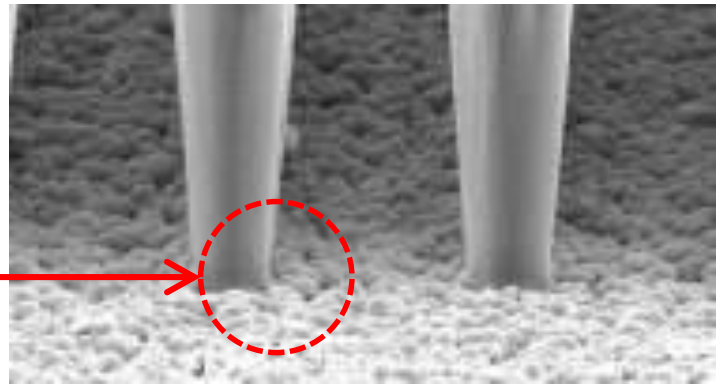
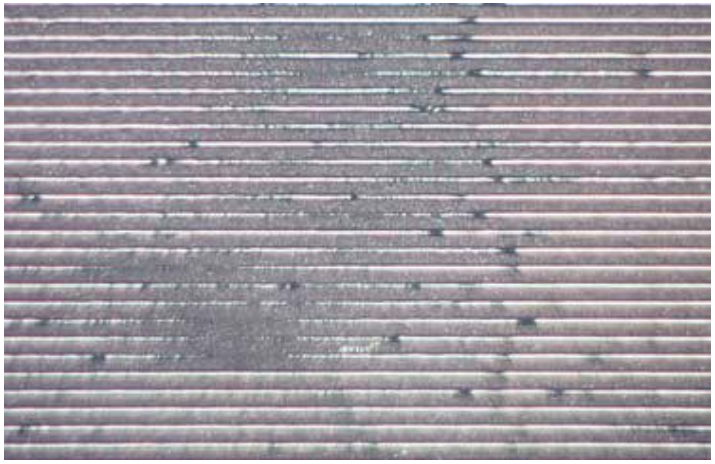
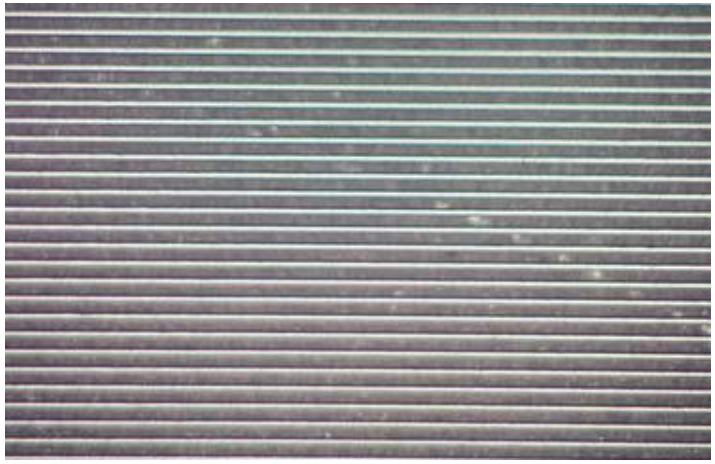


Prevent Cu plating failrure(×1000 microscope)

Untreated



Treated



Nissin Plasma Technologies; Descum for Cu pad

Application

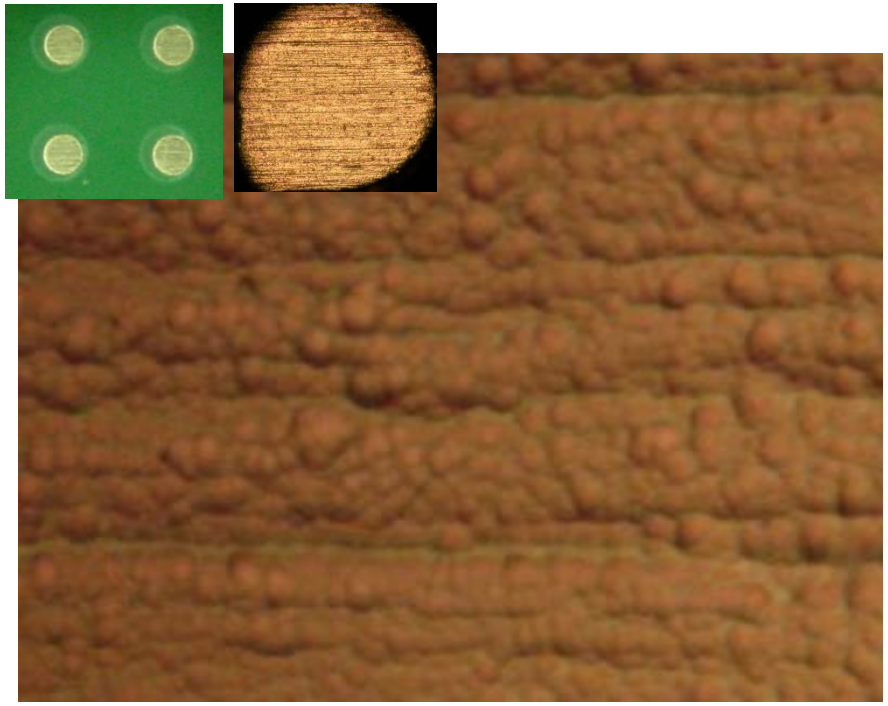
Improve wettability by removing micro residue on the surface of plated Cu pad

Application example

Process: Descum before Ni/Au plating
Measurement: Microscope

Result

Untreated



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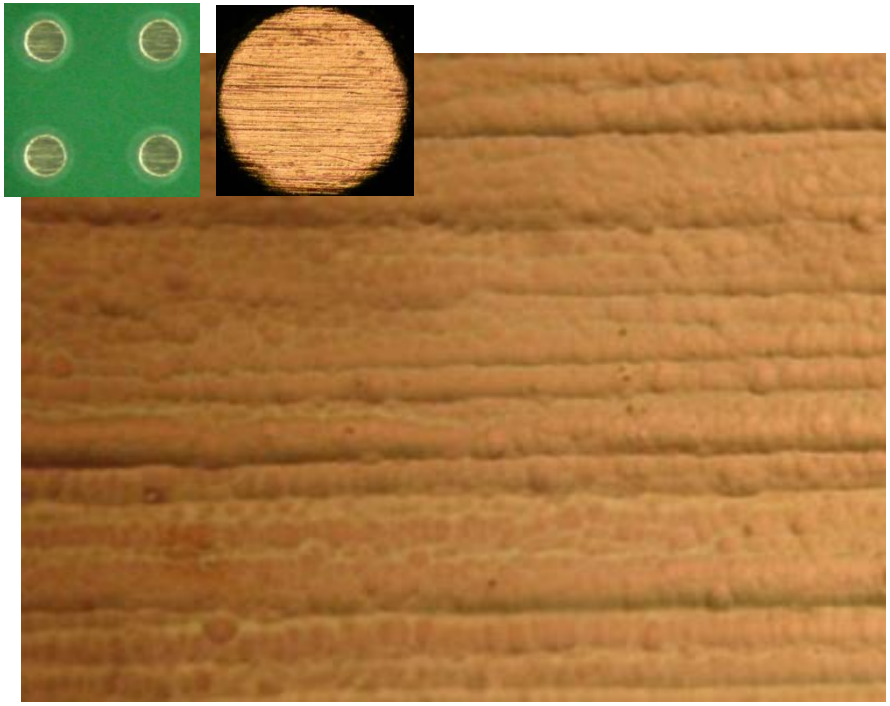


Nissin Plasma Equipment

Nissin Plasma Equipment ; Line-up

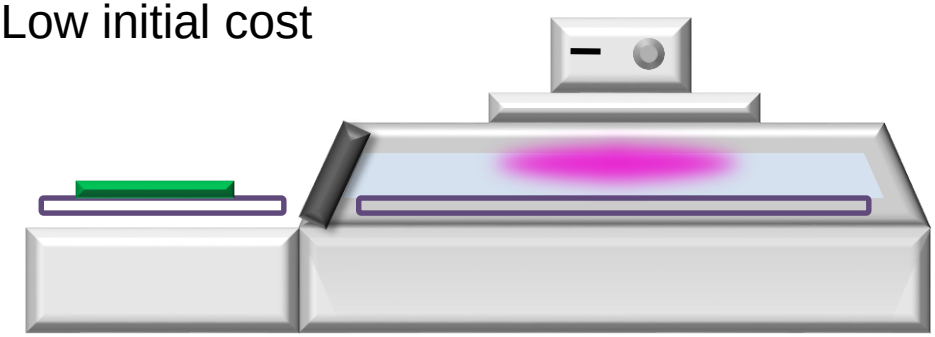
Confidential information

Sheet-by-sheet type M120-W	Roll to roll type M120-RTR	Wafer-level type Micro-Labo PS Ⅱ
		
For mass production	For mass production	For small production, R&D
PKG, COF, HDI	COF, Ultra-thin film, Fuel cell	SMT Backend、PKG、R&D
630mm×640mm	Width：540mm Outer diameter：φ500mm	120mm×100mm
Double-sided	Double-sided	Single-sided
Scanning process	Scanning process	Terminate process
Full automation available	Roll to roll available	Full-automation available

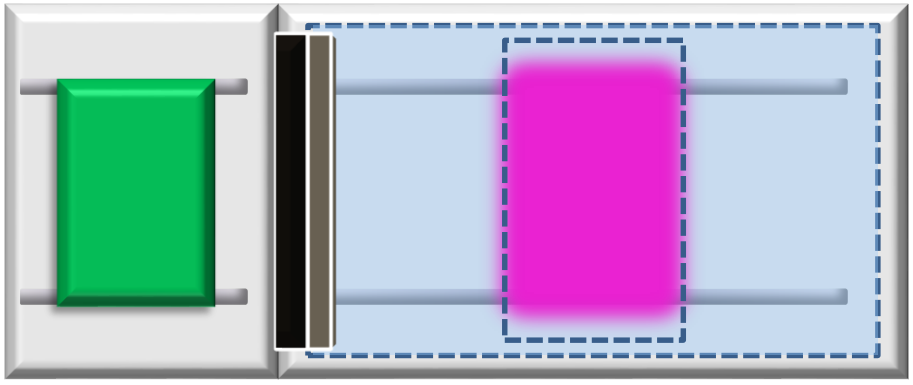
Process flow

Feature

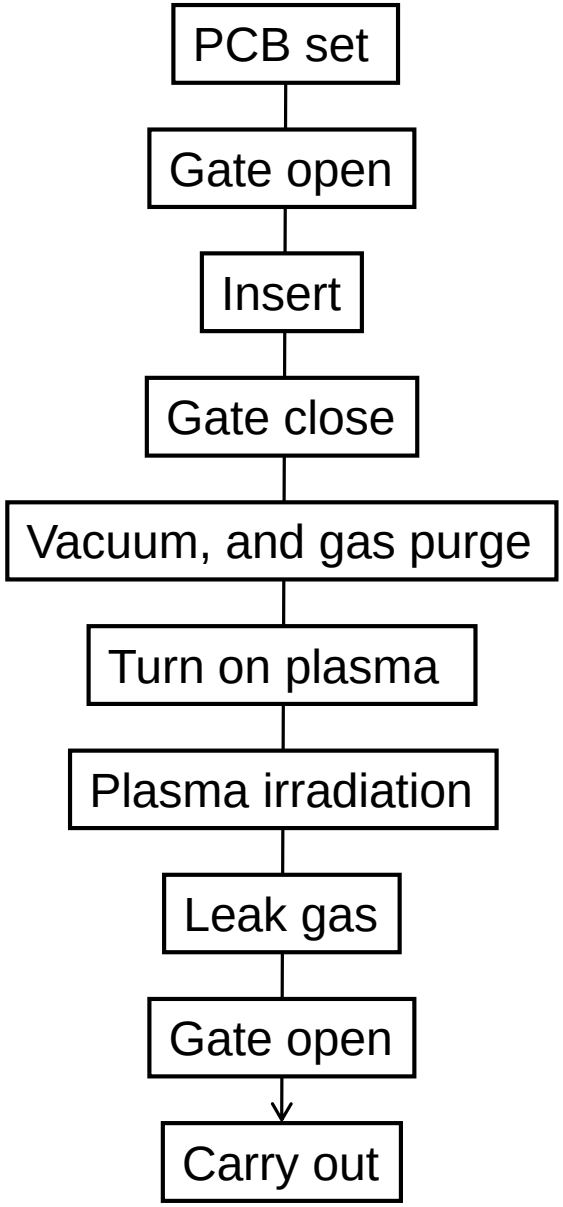
- Return type process
- Single-sided process
- Small footprint
- For small production use
- Low initial cost



Cross-section



Upper view



Nissin Plasma ; M120-W, sheet-by-sheet system

Specification

- Feature : Sheet by sheet type
  For mass production
- Working area : 630mm×640mm
- Size : 1730(W)×2530(D)×2000(H)mm
- Weight : 1500kg
- Processing type : Double-sided
  wafer-level processing

M120-W + Handling; Full-automation system　image

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Japan

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