



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

Microwave Plasma Application and Equipment

Nissin PLASMA SYSTEM

CATALOG

ver. 3.1



One technologies,
One solutions.

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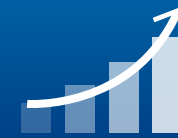
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One technologies,
One solutions.

NISSIN PLASMA SYSTEM

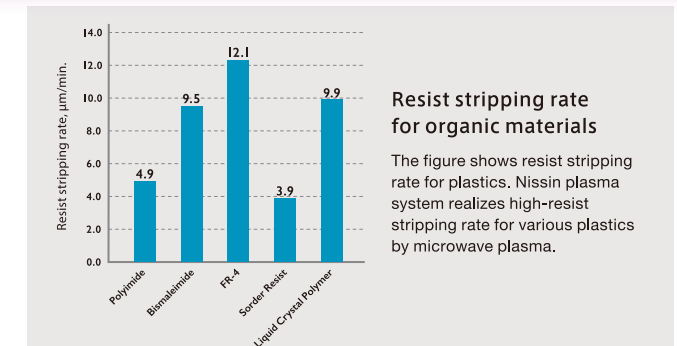
All developed by



HIGH SPEED

High power and high speed process

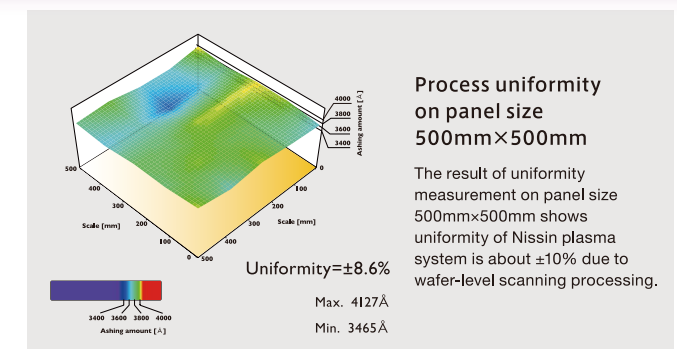
Electron density of Microwave plasma is about thousands times higher than that of RF plasma. High density microwave plasma can conduct high performance plasma processing.



EXCELENT UNIFORMITY

Large process area, high uniformity

Excellent uniformity process is achieved with originally developed scanning process.



LOW DAMAGE

Low damage process without bombardment

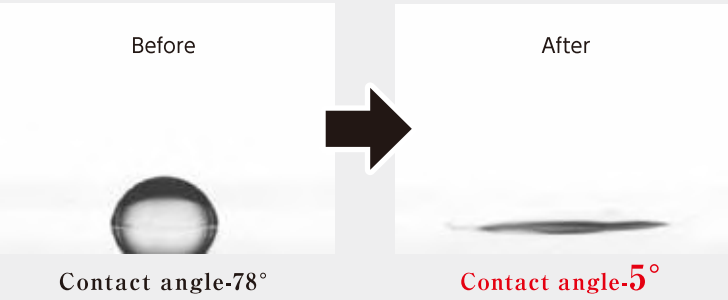
Isotropic plasma can be conducted the treatment without collision of ions and electrons. No bombardment process realizes low temperature process.

Available full Automation, In-line type, customization

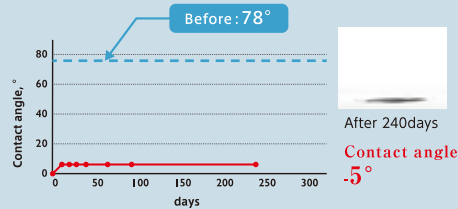
01 Surface Modification Process (improve wettability)

- Improve wettability of polymer or metal surface
- Surface modification for fluorocarbon polymers is possible
- Short-time plasma irradiation
- Long sustained effect

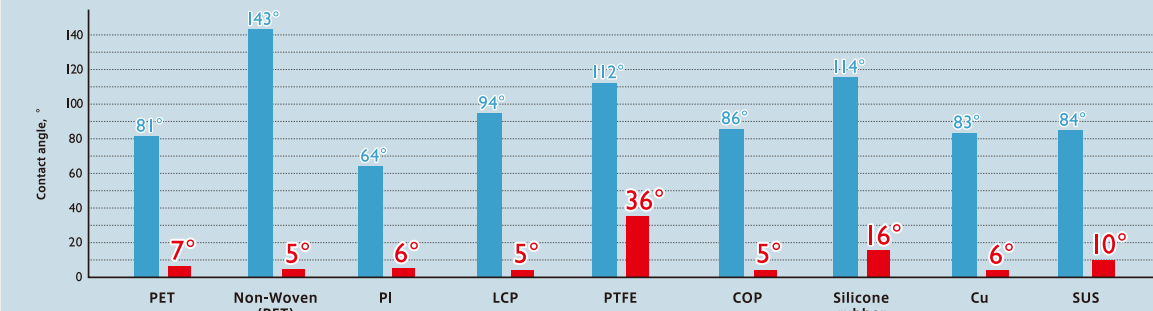
Surface modification for Polystyrene (PS)



Evaluate effect of sustainability (240days)



Surface modification for various materials

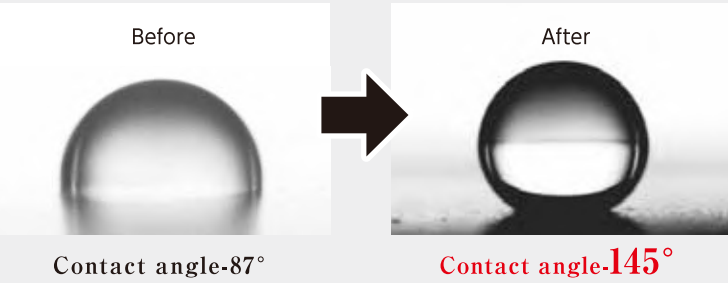


※under 5° is expressed as 5°

02 Surface Modification Process (improve hydrophobicity)

- Improve hydrophobicity of resin or metal surface
- Short-time plasma irradiation

Surface modification for Polyethylene (PE)



Materials	Contact Angle w/o plasma	Contact Angle w/ plasma
PET	81°	111°
PP	90°	132°
PC	85°	102°
Borosilicate Glass	10°	106°
SUS	84°	110°
Al	91°	111°

03 Plasma Application for Bio, Life Science (surface activation)

Activate surface of cell culture vessel

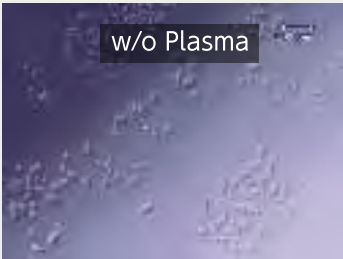
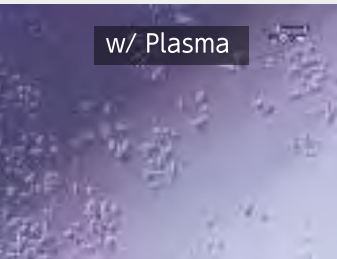
Evaluate cell cultivation speed on various surface

- improve cultivation speed
- High uniformity
- Long sustained effect

Test condition

Cell: PC12r+10%FBS10%HS

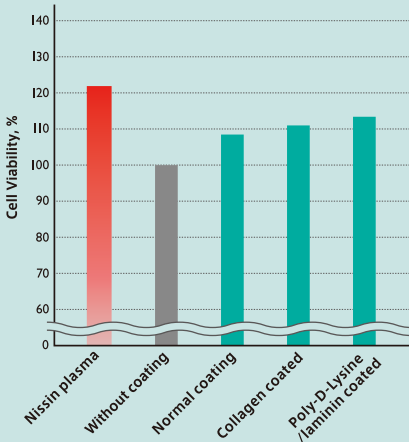
Condition: CO₂ incubator 48hrs



Evaluation: T-test

T value of Nissin plasma=0.044

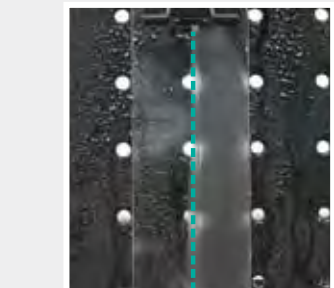
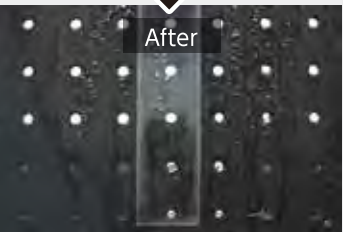
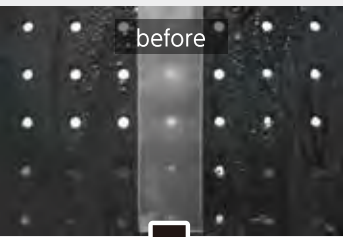
Intercomparison (no modification=100%)



Antifog process for acryl

Antifog for lense, glass, polymers

- Available for glass, or polymer
- Short-time plasma irradiation
- Long sustained effect



w/ Plasma w/o Plasma



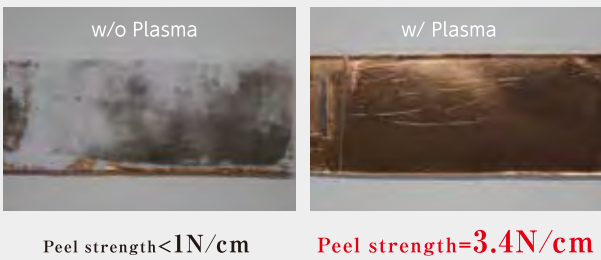
04 Improve Peel Strength of Plating or Adhesive

- Improve peel strength of polymer or metal
- Fluorocarbon polymers is possible
- Short-time plasma irradiation

Improve Peel Strength of Plating

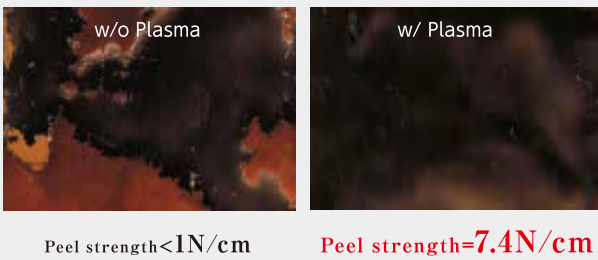
Improve adhesion strength between PTFE and Cu plating

ex) Electroless Cu plating on PTFE

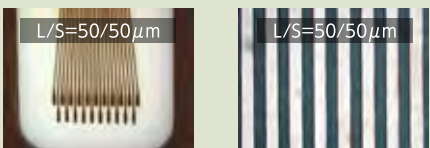


Improve adhesion strength between Polyimide and Cu plating

ex) Electroless Cu plating on PI without seed layer




Patterning on PTFE



Two micrographs showing narrow patterning on PTFE. The left image is labeled 'L/S=50/50μm' and shows a series of parallel lines. The right image is labeled 'L/S=50/50μm' and shows a series of parallel lines.

Narrow patterning can be conducted on the plasma treated PTFE with enough peel strength.

Plasma treatment improve surface chemical composition to increase peel strength of various polymers and electroless Cu plating.



PTFE-Photo resist adhesion (spin coating)

Develop liquid photo resist by spin coating on the PTFE



Polymer-Polymer adhesion

Adhesion strength between polymers (Adhesive: Epoxy)

PP-PP w/o plasma: <0.025N/mm²
Adhesion strength=7.4N/mm²

PEEK-PEEK w/o plasma: <0.4N/mm²
Adhesion strength=>2.5N/mm²

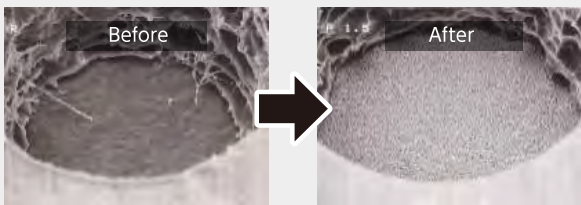
PTFE-PTFE w/o plasma: <0.0025N/mm²
Adhesion strength=0.5N/mm²



05 Plasma Application for PCB and Packaging

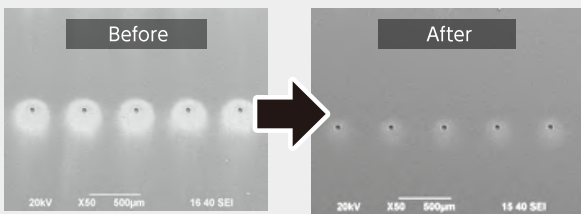
Desmear

SEM pictures of BVH



- Remove smear after laser drilling
- Clean up bottom and side-wall of via hole
- Prevent open failure

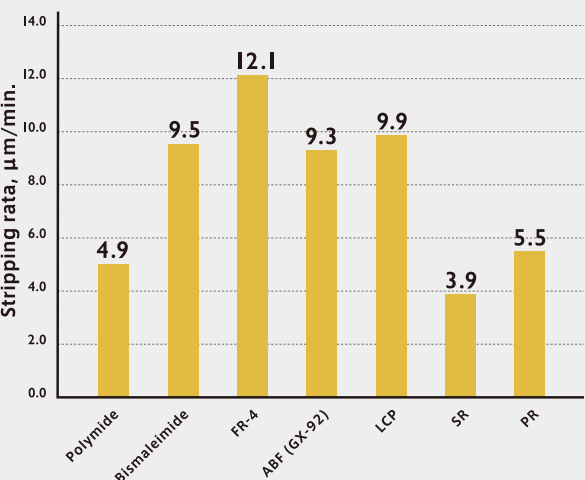
SEM pictures of FPC (Cu direct)



Remove dross around via holes after Cu direct laser drilling process for Polyimide



Stripping rate for various polymers



Microwave plasma realized high stripping rate compared to RF plasma.

Descum for patterning (SAP)

- Remove residue of DRF
- Improve wettability of Cu and DFR
- Short irradiation time
- High uniformity

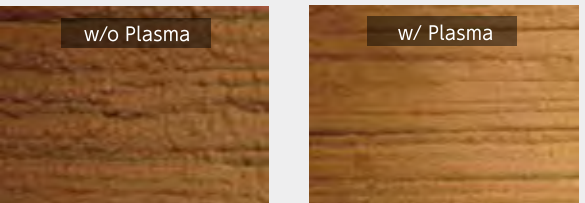
SEM pictures of patterning (L/S=10/10μm)



Descum before Ni/Au patterning

- Remove residue of SR
- Improve wettability of Cu and SR
- Control wettability of under fill
- Short irradiation time

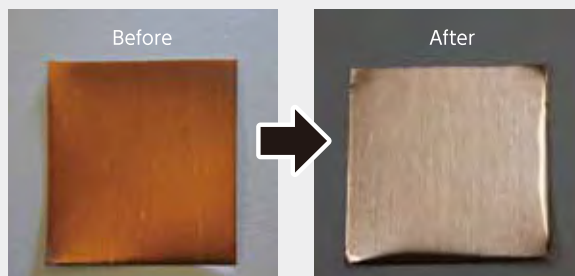
Surface of Au plating



06 Oxidized Layer Removal, Prevent oxidation

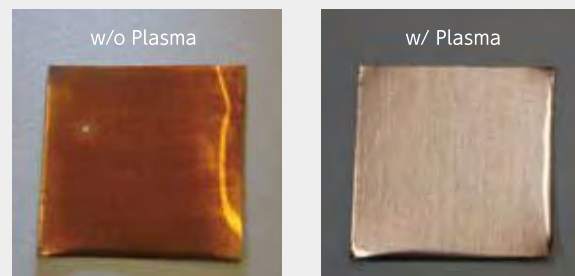
- Remove oxidized layer by reduction
- Long sustained effect
- Short-time plasma irradiation

ex) Oxidized layer removal for Cu



Remove oxidized Cu layer with short plasma treatment time.

ex) 1week later after plasma reduction



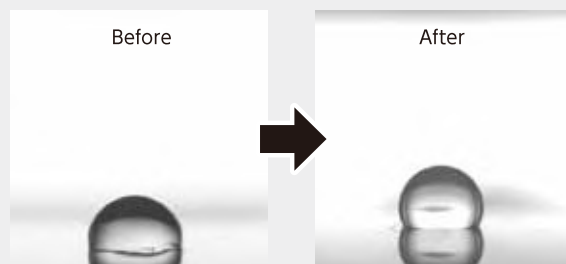
1 week later at humid condition

The effect of antioxidation sustain for long time after microwave plasma treatment. Good for control waiting time for next processing.

07 Deposition Process

- High deposition rate
- Adaptable deposition available

Hydrophobic deposition process



Deposition hydrophobic Layer on the surface of metal and polymer

Nitride deposition process

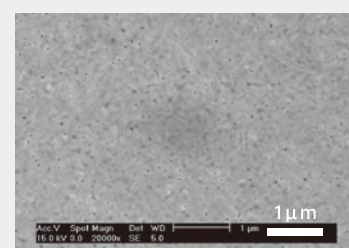


Deposition nitride on the metal for improve wettability or other functions

08 Nano Paste Sintering Process

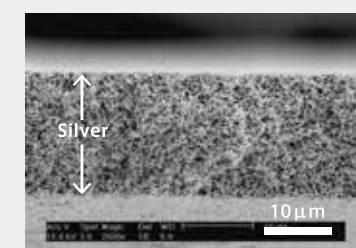
- Low temperature process
- Short-time plasma irradiation

Sintering Ag nano paste on PET



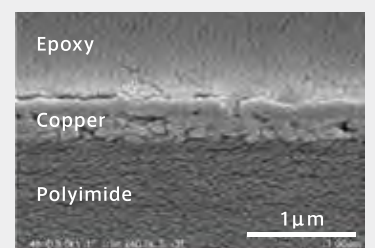
Base: PET
Film thickness: 0.2m
Resistivity: $2.9\mu\Omega \cdot \text{cm}$
Ink maker: Harima chemical
Plasma treatment: 40sec.

Sintering Ag nano paste on SiO₂



Base: SiO₂
Film thickness: 19.4m
Resistivity: $3.9\mu\Omega \cdot \text{cm}$
Ink maker: Harima chemical
Plasma treatment: 90sec.

Sintering Cu nano paste on PI

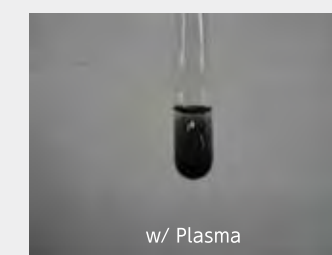
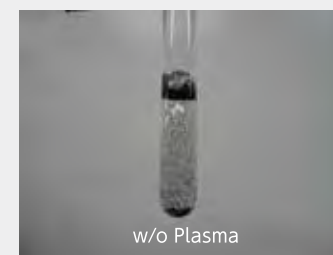


Base: PI
Film thickness: 0.38m
Resistivity: $5.1\mu\Omega \cdot \text{cm}$
Ink maker: Ishihara sangyo
Plasma treatment: 180sec.

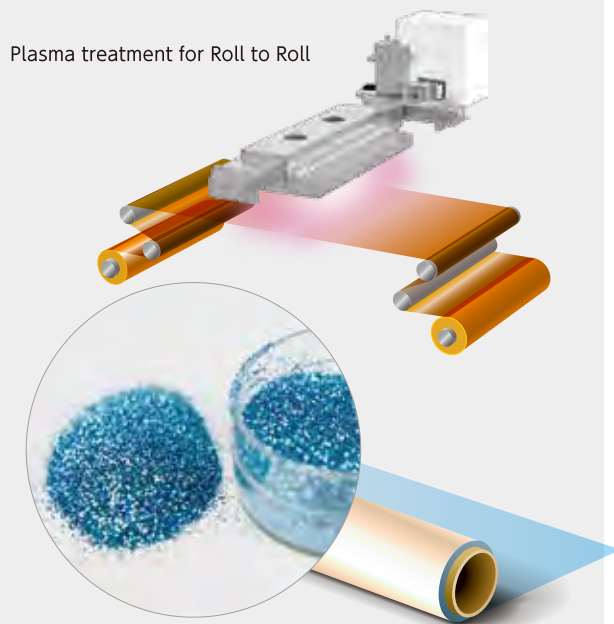
09 Plasma Process for Specific Materials

- Roll to Roll
- Powder
- 3D objects etc.

Surface modification for powder



Plasma treatment for Roll to Roll



Originally developed various plasma equipment is available for experimental use, and mass production.
All equipment can be customized to satisfy customers demand



Micro Labo-PS2
Experimental use, small footprint

Small footprint, low price p.11



M120W
Large process area, Mass production use

standard model p.12



M120W++ Handling system
Customized example: Full automation model

Full automation p.13



M220W-HR
High-throughput, Large process area, Mass production use

Load-lock system p.14



R220W
Roll to Roll Plasma System, Mass production use

Available for ultra-thin film p.15

Experimental use, small footprint

Small footprint, low price



Type
Micro Labo-PS2

Main unit size	W: 725mm D : 530mm H : 1610mm
Main unit weight	200kg
Working area	120 × 100 × 70mmt
Processing type	Single sides
Feature	Film, panel, 3D object

Optimized for R&D

Generate high power microwave plasma with small footprint design.
Wide variety of process recipe available

Easy operation

Installed 7' touch panel to realize easy operation.
Interlock system is installed for safety.

Available customization

Customization is available, ex. process gas, vacuum pump, stage heater etc.



Large process area, Mass production use

standard model

Full automation



Type
M120W

Main unit size	W: 1730mm D: 2530mm H: 2000mm
Main unit weight	1800kg
Working area	630 × 640 × 20mmt
Processing type	Both sides
Feature	Film, panel

Customized example : Full automation model

Full automation, Mass production
M120W+Handling system



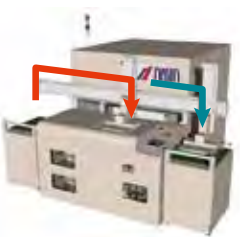
[Automation Sequence]



Take a panel from loader and set the panel on the process tray



Next panel is ready for loading while the panel is treated in the chamber



The treated panel is conveyed to unloader, at the same time, new panel is set to the process tray



After the treatment, the sequence is repeated

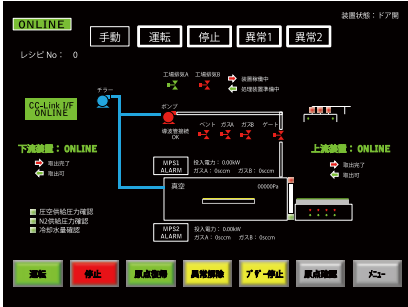
High power

High density microwave plasma system realizes high power and large working area process. Excellent uniformity process is achieved with originally developed scanning process.



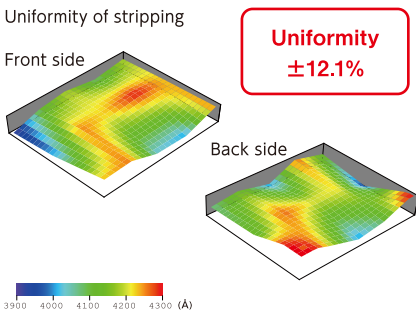
Mass production

Functions for production is installed, ex. touch panel operation, interlock system, and safety control etc. Logging system is also available.

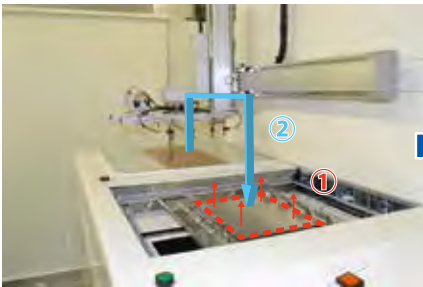


Double-sided process

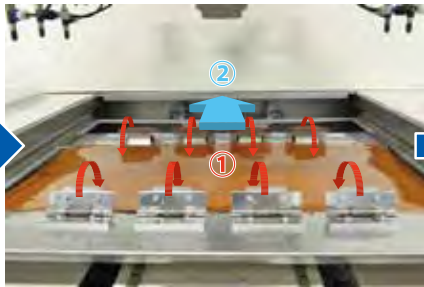
Two reactors for upper and bottom side are installed, which realize double sided process simultaneously.



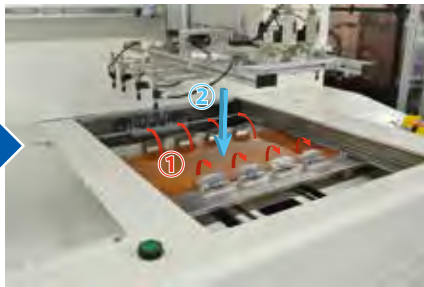
Automated clump system for film or FPC



Rise up holder and set the panel clumping position



Clump the panel, then the holder goes down



After the plasma treatment, the holder rise up and open clump automatically

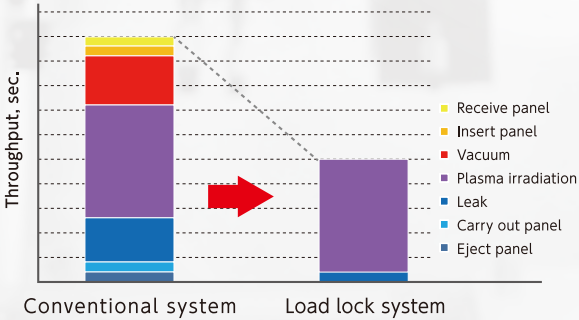
High-throughput, Large process area, Mass production use

Load-lock system



Type
M220W-HR

Main unit size	W : 5800mm D : 1830mm H : 2020mm
Main unit weight	5000kg
Working area	540 × 640 × 20mmt
Processing type	Both sides
Feature	Film, panel



Roll to Roll Plasma System, Mass production use

Available for ultra-thin film

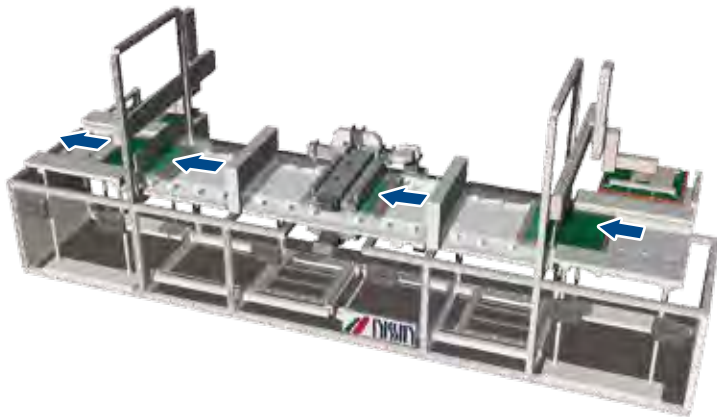


Type
R220W

Main unit size	W : 2000mm D : 1700mm H : 2140mm
Main unit weight	3500kg
Working area	540 × 50μmt Outside diameter of Roll : φ500mm
Processing type	Both sides
Feature	Film

Load and unload lock system

Improve through put with load and unload lock chamber system. Full automation in line is available.



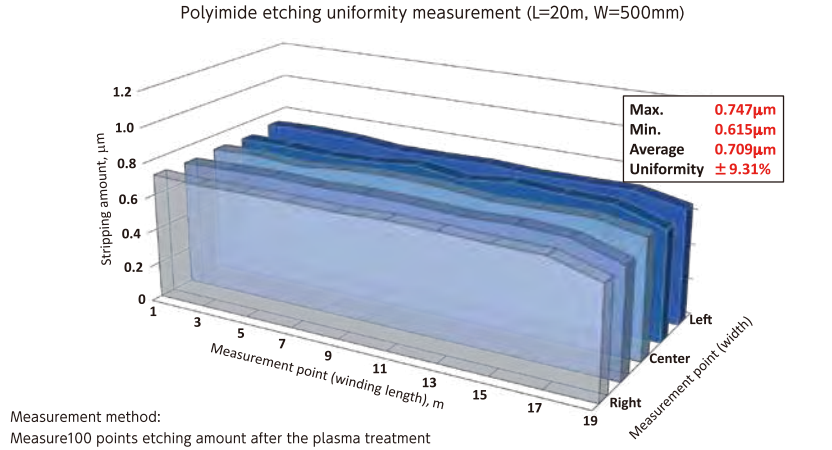
Available thin film, double sided process

Clump system is installed for ultra thin film treatment.



High performance, high uniformity

High performance and uniformity RtoR processing with microwave plasma system.



Customization available

Available customization ex. EPC, tension control, film size etc.

