# Plasma Cleaning Machine

- Vacuum Low Pressure Plasma Cleaning Machine
- Atmospheric Pressure Plasma Surface Treatment

Skymen Technology Corporation Limited

www.skymen.cc

# Committed to Providing Cutting-edge Plasma Surface Treatment Solutions

Skymen specializes in the development and manufacturing of innovative plasma surface treatment solutions for customers around the world. Our main products include vacuum low-pressure plasma cleaning machines, atmospheric pressure plasma surface treatment machines, and wide-width online plasma surface treatment equipment. Widely used in surface cleaning, activation, etching, coating, etc., in optics, electronics, automobiles, textiles, semiconductors, packaging, precision manufacturing, and other industries.

**2007**
Founded

**350+**
Employees

**65+**
Engineers

**400+**
Patents

**35000+ $m^2$**
Plant

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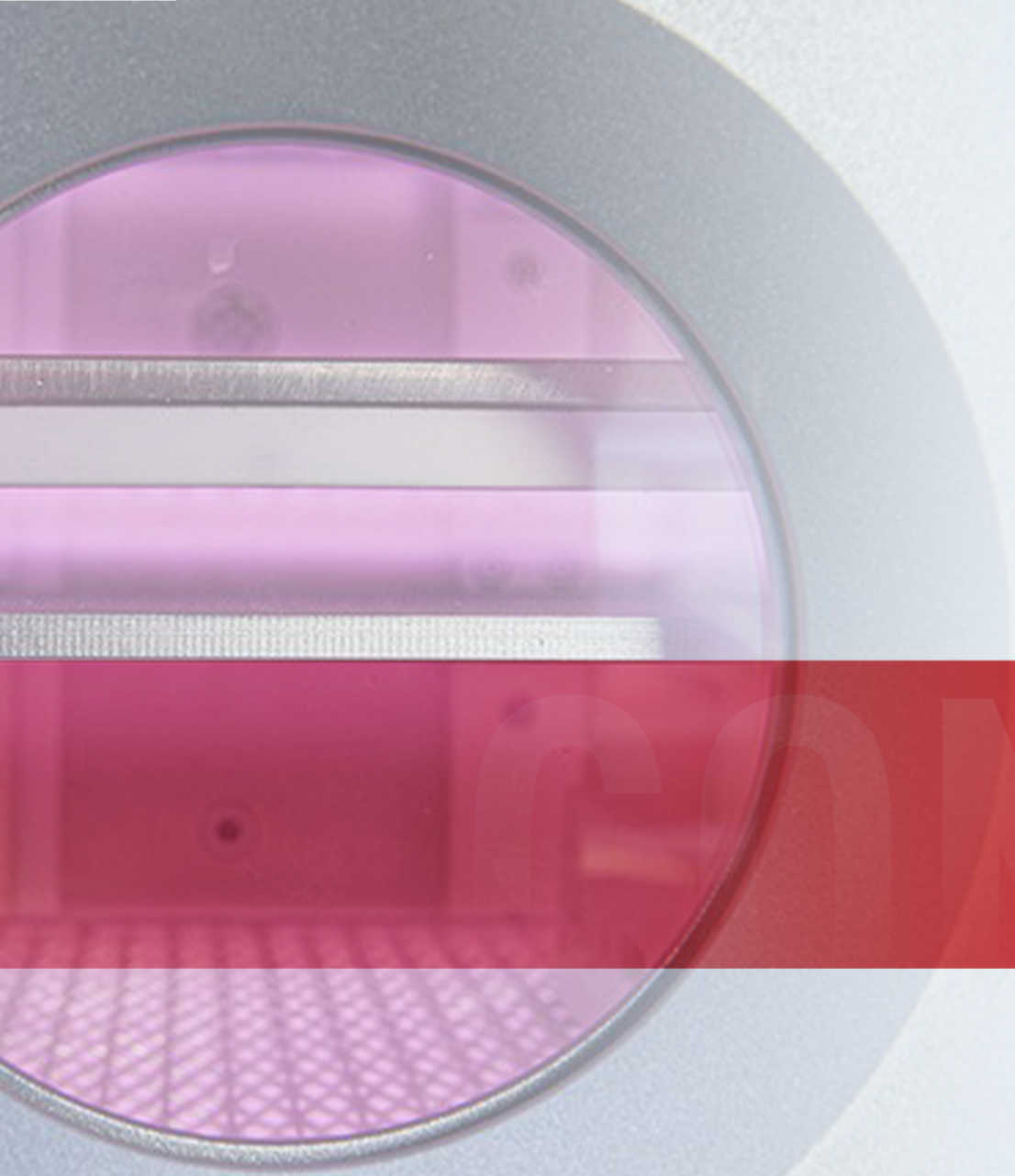


# PART ONE.

## Vacuum Low Pressure Plasma Series

# Small Vacuum Low Pressure Plasma Cleaning Machine

It is suitable for sample research and teaching in university laboratories, scientific research institutions, etc., or for small-batch production in the industrial field

## Features

- PLC+HMI control, simple operation
- Supports authority classification and independent password lock
- It can switch between manual mode and automatic mode
- With multiple interlocking functions to ensure the safety of equipment use
- High vacuum chamber design and manufacturing process with excellent sealing
- Over-temperature, overload, short circuit and other abnormal prompts and alarm functions
- Unique discharge technology, plasma formation is uniform and stable, and the treatment effect is more outstanding
- Ultra-low temperature treatment, no damage to the substrate, compatible with various materials

Low temperature treatment

Wide range of applications

No waste liquid discharge

Low energy consumption

Fine cleaning

| Model | | JMD-ZKG-05D | JMD-ZKG-08D |
|---|---|---|---|
| Spec. | Machine dimension (mm) | 415*600*450 | 415*600*450 |
| | Chamber dimension (mm) | Φ150*260 | 180*260*160 |
| | Capacity (L) | 5 | 8 |
| | Weight (KG) | 45 | 45 |
| Plasma power | High frequency (40KHz) | 200W | 200W |
| | Radio frequency (13.56MHz) | 100W | |
| Control system | Working mode | Manual/automatic | |
| | Control mode | PLC+HMI | |
| | Touch screen | 7″ | |
| Gas system | Gas channel | 2 ways | |
| | Flow range | 0-240sccm | |
| | Flow meter | 2 float flowmeters | |
| | Gas interface | Hose (6mm outer diameter) | |
| | Gas pressure | 0.1-0.2MPa | |
| | Process gas | Oxygen, nitrogen, argon, hydrogen or mixed gas, etc. | |
| Pallet | Size (mm) | 145*255 | 160*240 |
| | Number of layers | 1 layer | 1 layer, 3 adjustable layer heights |
| | Material | 304 stainless steel (sandblasting + electropolishing) | |
| Vacuum system | Pumping speed | 4m3/h | |
| | Ultimate vacuum degree | Below 10Pa | |
| | Vacuum pump | Oil pump / dry pump (origin and brand optional) | |
| | Vacuum gauge | Imported pirani | |
| | Range (pa) | $1\times10^{-2}$ ~ $1\times10^{5}$ | |
| Spare parts | | Vacuum pump exhaust port filter*1, stylus*1, stainless steel bellows*1 | |

# Large Vacuum Low Pressure Plasma Cleaning Machine

It is suitable for pre-production process verification or mass production processing in the industrial field

## Features

- PLC+human-machine interface control, simple operation
- Supports authority classification and independent password lock
- It can switch between manual mode and automatic mode
- With multiple interlocking functions to ensure the safety of equipment use
- High vacuum chamber design and manufacturing process with excellent sealing
- Over-temperature, overload, short circuit and other abnormal prompts and alarm functions
- Unique discharge technology, plasma formation is uniform and stable, ensuring better treatment effect
- Ultra-low temperature treatment, no damage to the substrate, compatible with various materials
- Layered design of vacuum chamber, flexible adjustment according to the size of the processed product
- Equipped with Foma casters, which are height-adjustable and dust-proof

Low temperature treatment

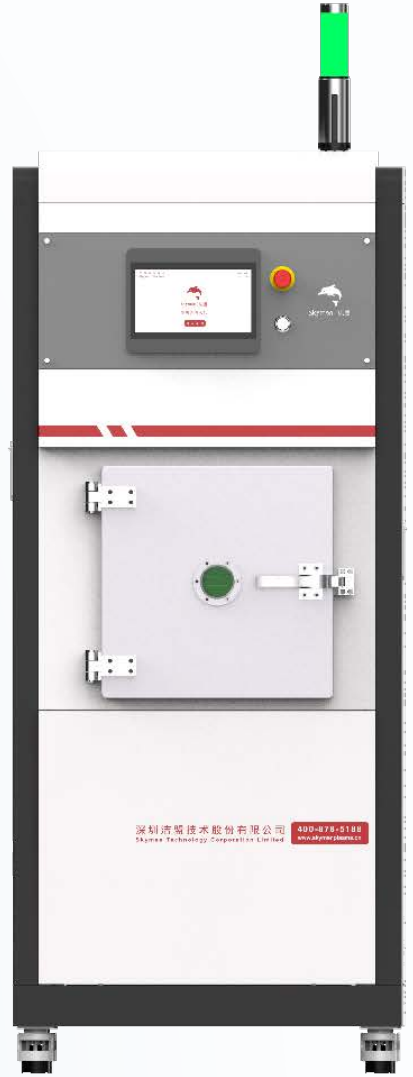
Wide range of applications

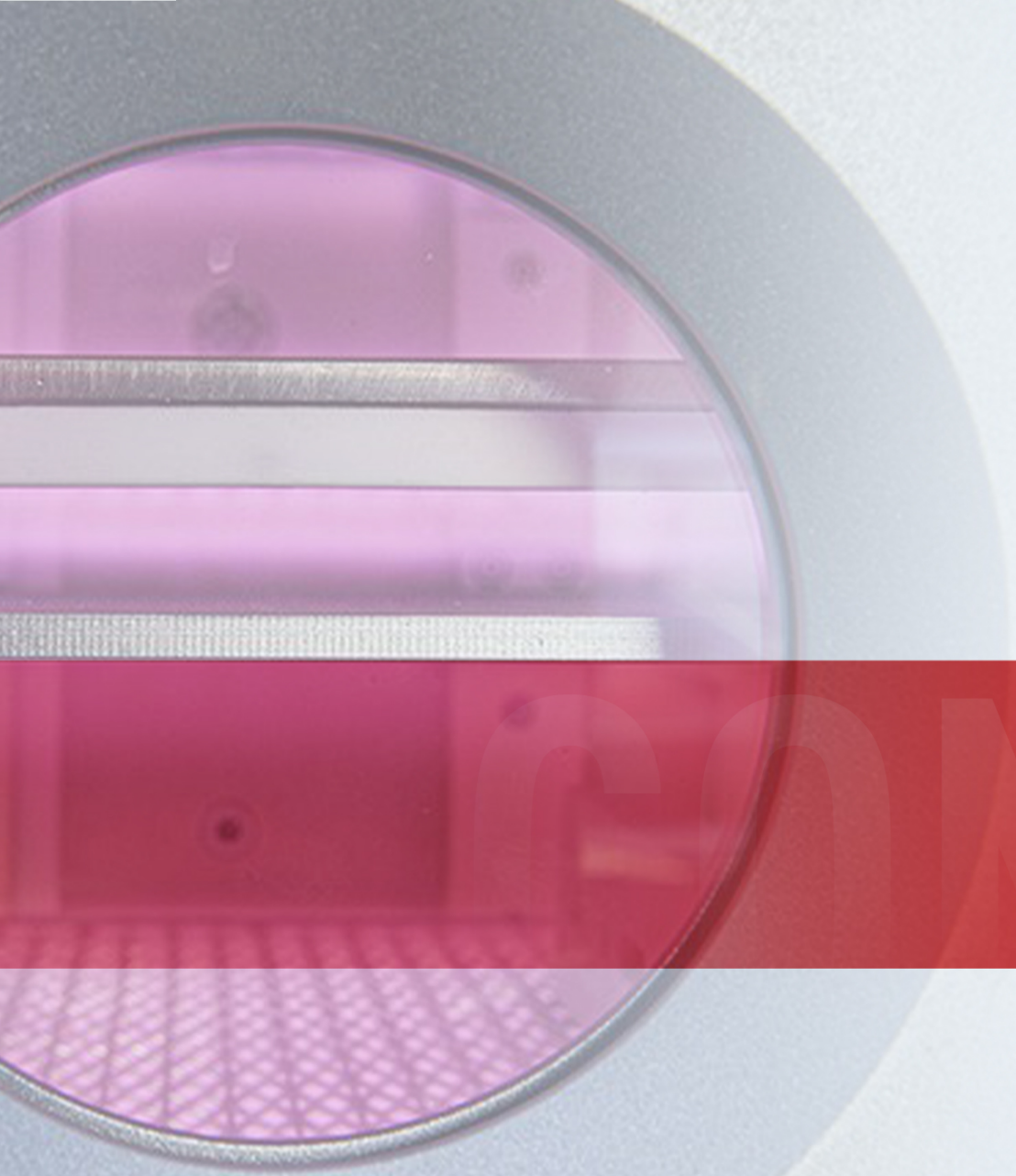
No waste liquid discharge

Low energy consumption

Fine cleaning

| Model | | JMD-ZKG-20D | JMD-ZKG-35D | JMD-ZKG-60D | JMD-ZKG-100D | JMD-ZKG-300D |
|---|---|---|---|---|---|---|
| Spec. | Machine dimension (mm) | 650*800*1750 | 650*800*1750 | 750*800*1750 | 750*800*1750 | 1500*1300*1750 |
| | Chamber dimension (mm) | 260*260*300 | 300*300*400 | 400*400*400 | 400*500*500 | 700*600*800 |
| | Capacity (L) | 20 | 35 | 60 | 100 | 300 |
| | Weight (KG) | 200 | 220 | 260 | 260 | 560 |
| Plasma power | High frequence (40KHz) | 500W | 500W | 1000W | 1500W | 5KW / 10KW |
| | Radio Frequency (13.56MHz) | 300W | 300W | 500W | 500W / 1000W | 2000W |
| Control system | Working mode | Manual / automatic | | | | |
| | Control mode | PLC+HMI | | | | |
| | Touch screen | 10″ | | | | 14″ |
| Gas system | Gas channel | 2-4 ways | | | | |
| | Flow range | 0-200sccm / 0-500sccm option | | | | |
| | Flow meter | 2-4pcs mass flow meter (MFC) | | | | |
| | Gas interface | Hose (6mm outer diameter) | | | | |
| | Gas pressure | 0.1-0.2MPa | | | | |
| | Process gas | Oxygen, nitrogen, argon, hydrogen or mixed gas, etc. | | | | |
| Pallet | Size (mm) | 225*255 | 265*355 | 365*355 | 365*455 | 665*750 |
| | Number of layers | 2-4 layer | 2-4 layer | 3-6 layer | 3-7 layer | 6-10 layer |
| | Material | 304 stainless steel (sandblasting + electropolishing) | | | | |
| Vacuum system | Pumping speed | 16$m^3$/h | | 30$m^3$/h | | 60+280$m^3$/h |
| | Ultimate vacuum degree | below 10Pa | | | | |
| | Vacuum pump | Oil pump / dry pump (origin and brand optional) | | | | |
| | Vacuum gauge | Imported pirani | | | | |
| | Range (pa) | $1\times10^{-2}$-$1\times10^{5}$ | | | | |
| Spare parts | | Vacuum pump exhaust port filter*1, stylus*1, stainless steel bellows*1 | | | | |





# PART TWO.

## Atmospheric Pressure Plasma Series

# Rotary Jet Atmospheric Pressure Plasma Surface Treatment Machine

The rotating jet enables plasma treatment on the workpiece with a high relative speed as a result of the rotation principle, achieving a very uniform treatment effect and allowing for a wider processing surface

## Features

- It can be integrated into production lines or robot systems
- Compact design saves space when used or integrated
- Uses a microprocessor controller to control parameters
- It can operate at high loads in harsh environments
- Supports customized text display in different languages

| Model | | JX-XZ-1000D |
|---|---|---|
| Spec. | Size (mm) | 494*577*168 |
| | Weight (KG) | 12 |
| | Frequency (kHz) | 30 |
| | Power (W) | 1000 |
| | Control | Close control or PLC |
| Plasma rotary jet | Size (mm) | 308*Φ80 |
| | Weight (KG) | 2-4 |
| | Processing width (mm) | 20-100 |
| Process gas | Gas | Compressed air/ nitrogen |
| | Pressure (MPa) | 0.3-0.6 |
| Power supply | | 220V 50/60Hz |

# Direct Jet Atmospheric Pressure Plasma Surface Treatment Machine

It is mainly used when parts are to be plasma-treated with high process speed, high energy, or selectively when only a certain part of a workpiece is to be treated. Currently, more than 10 different types of jet heads are available

## Features

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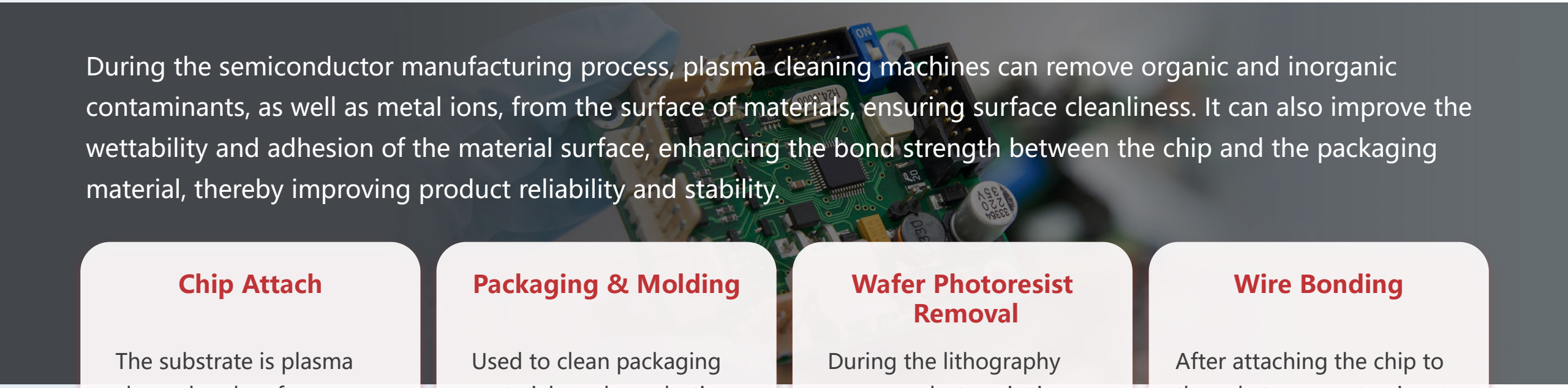
| Model | | JX-ZP-1000D |
|---|---|---|
| Spec. | Size (mm) | 494*577*168 |
| | Weight (KG) | 12 |
| | Frequency (kHz) | 30 |
| | Power (W) | 1000 |
| | Control | Close control or PLC |
| Plasma rotary jet | Size (mm) | 240*Φ30 |
| | Weight (KG) | 2-4 |
| | Processing width (mm) | 5-12 |
| Process gas | Gas | Compressed air/ nitrogen |
| | Pressure (MPa) | 0.3-0.6 |
| Power supply | | 220V 50/60Hz |

# PART THREE.

## Industry Applications

# Semiconductors



During the semiconductor manufacturing process, plasma cleaning machines can remove organic and inorganic contaminants, as well as metal ions, from the surface of materials, ensuring surface cleanliness. It can also improve the wettability and adhesion of the material surface, enhancing the bond strength between the chip and the packaging material, thereby improving product reliability and stability.

## Chip Attach

The substrate is plasma cleaned and surface activated to enhance the adhesion of the die attach epoxy, thereby improving the bond between the chip and substrate.

## Packaging & Molding

Used to clean packaging materials such as plastics and ceramics, removing organic contaminants from the surface and improving the adhesion and reliability of packaging materials.

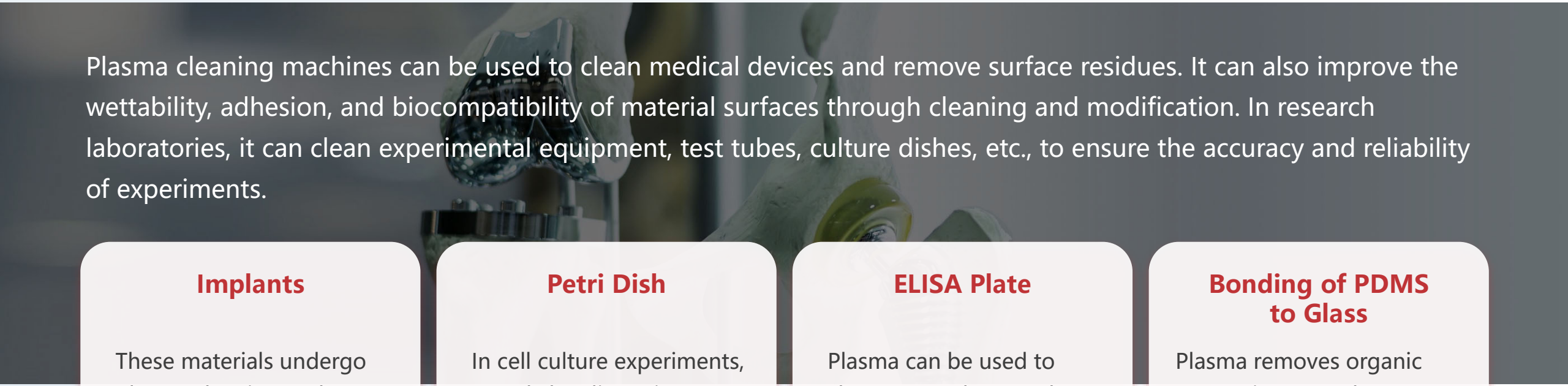
## Wafer Photoresist Removal

During the lithography process, photoresist is used to define the pattern of the device. After the lithography is completed, a plasma cleaner can quickly and thoroughly remove the photoresist residue.

## Wire Bonding

After attaching the chip to the substrate, contaminants like particles and oxides can harm the bonding process. Plasma cleaning effectively removes these contaminants from metal wires and pins, enhancing bonding reliability and stability.

# Biomedicine



Plasma cleaning machines can be used to clean medical devices and remove surface residues. It can also improve the wettability, adhesion, and biocompatibility of material surfaces through cleaning and modification. In research laboratories, it can clean experimental equipment, test tubes, culture dishes, etc., to ensure the accuracy and reliability of experiments.

## Implants

These materials undergo plasma cleaning and modification treatment to remove organic matter, oxides, and impurities on the surface, improve the wettability, adhesion, and biocompatibility of the material surface.

## Petri Dish

In cell culture experiments, vessel cleanliness is essential for cell growth. Plasma cleaning effectively remove residual cells and contaminants, ensuring sterility and providing an optimal environment for cell culture.

## ELISA Plate

Plasma can be used to clean ELISA plates and improve surface properties, such as by introducing active functional groups, such as aldehyde, amino, and epoxy groups, to enhance surface wettability and adhesion.

## Bonding of PDMS to Glass

Plasma removes organic contaminants and microparticles from PDMS and glass surfaces, making them cleaner and smoother for a tighter bond. It also alters the chemical properties of these surfaces by introducing reactive groups that improve bond strength.

# Consumer Electronics

Plasma cleaning machines play an important role in the manufacturing process of mobile phones, electronic watches, tablets, and other 3C electronic products. It effectively removes organic pollutants on the surface of products, improves the adhesion performance of product components, enhances the structural strength and stability of products, and ensures the safety and reliability of products.

## Speakers/ Headphones

Sound quality is vital for high-end mobile phones. Key speaker components and effective bonding are essential. Plasma activation treatment improves bonding strength, enhancing sound quality and drop resistance.

## Camera Module

The COMS camera production involves lens cleaning, circuit welding, and packaging. Contaminants like organic pollutants or oxide layers can affect performance and reliability. Plasma cleaning effectively removes these, leading to stronger welding and packaging.

## Phone Case/ Screen

Bonding the screen to the back cover involves a narrow contact surface that requires higher adhesive strength. Plasma treatment of the back cover boosts surface activity, enhancing adhesive strength, bonding strength, and drop resistance.

## Phone Antenna/ FPC

Downstream FPC customers typically perform incoming material inspections, including wire bonding and pull tests. Contamination from unclean surfaces often results in test failures. To avoid these issues, plasma cleaning is conducted on the surface.

# Optics & Photoelectricity

Plasma cleaning systems play a key role in the cleaning process of optical devices and electronic components, effectively removing surface impurities and providing a clean, high-quality substrate for subsequent coating, printing, bonding, and spraying processes. It also increase the wettability, adhesion, and hydrophilicity of the material surface, improving its ability to bond with other substances.

## Before ITO Conductive Glass Coating

Plasma cleaning effectively cleans and activates ITO conductive glass, removing dirt and enhancing surface wettability, which improves adhesion between the film layer and the substrate, thereby improving the quality and performance.

## Optical Lenses

Plasma cleaning can efficiently remove organic pollutants from the surface of optical lenses, helping to improve the optical performance and durability of the lenses.

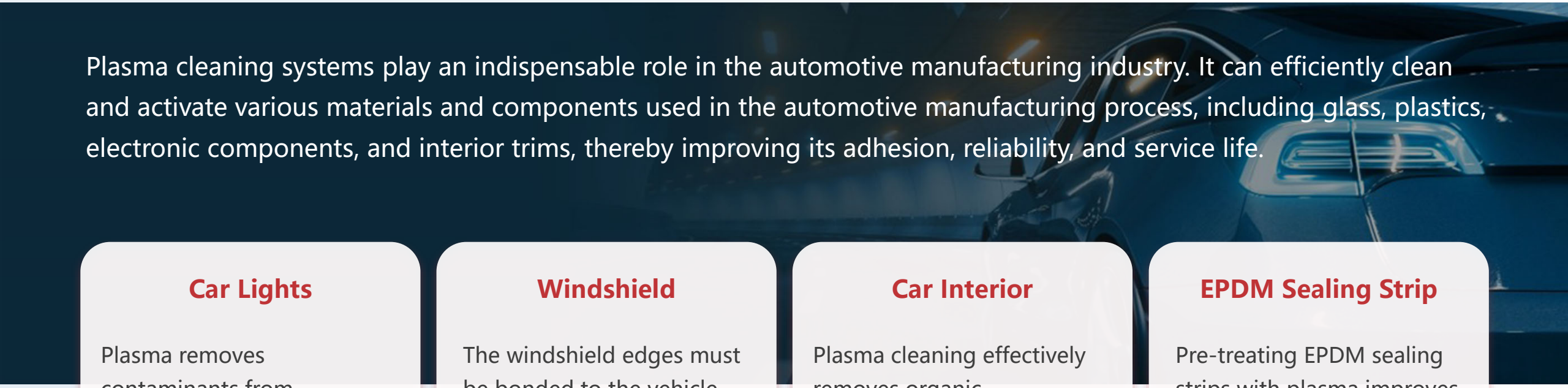
## LED Lead Frame

Contaminants on the LED silver glue's substrate can cause it to become spherical, complicating chip placement and risking damage. Plasma cleaning enhances surface roughness and hydrophilicity, improving glue flattening and chip adhesion while reducing usage and costs.

## UV/IR Filter Lenses

Plasma cleaning can clean and activate the surface of UV/IR filter lenses, increasing the surface's hydrophilicity and adhesion, helping to enhance the compatibility of the lenses with other optical components, and improving overall optical performance.

# Automobile



Plasma cleaning systems play an indispensable role in the automotive manufacturing industry. It can efficiently clean and activate various materials and components used in the automotive manufacturing process, including glass, plastics, electronic components, and interior trims, thereby improving its adhesion, reliability, and service life.

## Car Lights

Plasma removes contaminants from automotive lights and seal areas, improving surface cleanliness and adhesion. This treatment enhances coating adhesion and weather resistance while preventing moisture and dust infiltration.

## Windshield

The windshield edges must be bonded to the vehicle body. Plasma cleaning pre-treats the surface, removing contaminants and enhancing adhesion for better bonding or printing.

## Car Interior

Plasma cleaning effectively removes organic contaminants and generates reactive radicals, achieving both cleaning and activation. It enhances bonding strength and improves the quality of coatings or printing on automotive interior parts.

## EPDM Sealing Strip

Pre-treating EPDM sealing strips with plasma improves surface wettability and adhesion, enhancing the bonding strength for coatings and adhesives and laying a solid foundation for subsequent coating, bonding, and other processes.

# Textile Printing & Dyeing

In the textile industry, plasma technology can be widely used to treat the surface of fibers, yarns, tops, fabrics, and other materials, improving their surface properties and addressing surface defects. This change makes textiles easier to handle during dyeing and printing, improving production efficiency.

## Polyester Heat Transfer Printing

Before printing, polyester is treated with plasma to enhance its surface and hydrophilicity, increasing the specific surface area. This treatment improves dye adhesion and boosts color yield in digital heat transfer printing.

## Wool Shrinkage Proof, Dyeing, and Printing

Plasma treatment of wool reduces directional friction, making it shrink-proof. It alters the fiber's physical and chemical structure, enhances surface hydrophilicity and wettability, and improves dyeing performance by increasing dyeing rate and adsorption capacity.

## Cotton/ Linen Fabric Pretreatment and Dyeing

Plasma treatment increases the hydrophilicity of the fabric, facilitating the penetration of sizing agents and reducing the use of additives. Furthermore, plasma grafting polymerization changes the fiber surface, achieving a darker dyeing effect.

## High-performance Fibers and Polymer Modification

High-performance fibers and polymers with strong internal cohesion or non-polar surfaces can be challenging to bond during fabrication. Plasma improves wettability and increases surface roughness, enhancing adhesion between the materials.

# Packaging Printing

Plasma cleaning machines can significantly improve printing and bonding quality in packaging printing. By activating the material surface, it enhances wettability and adhesion, optimizes ink adhesion, and improves bonding quality to ensure bonding quality and enhance printing effects, while achieving environmental protection and energy saving.

## Pre-press Processing

Plasma surface pretreatment enhances ink adhesion and print quality for products made from polypropylene (PP), polyethylene (PE), polyamide (PA), and polycarbonate (PC) before pad, screen, and offset printing.

## Pre-treatment of Box Gluing

Plasma treatment of bonding areas in envelopes, notebooks, file bags, packaging boxes, and handbags improves surface tension and bonding strength, reduces glue delamination, and ensures product quality. (Compatible with box gluing machine production lines)

## Tag Processing

With the help of the plasma cleaning, multiple process effects can be achieved on the same label product, giving the label a unique visual effect and touch, which is particularly evident in the anti-counterfeiting effect.

## Glass Bottles
**(Seasonings/ Beverages/ Perfumes)**

For glass bottles, plasma treatment activates the surface, which enhances the wettability and adhesion of the bottle surface, improves the adhesion of the ink, and thus ensures the firmness of the label, pattern or text, making the coding or printing clearer and more durable.

# SKYMEN PLASMA

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