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Plasma-Surface-Technology

Introduction of Diener Plasma Surface Treatment Technology

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1. Technology of Plasma Surface Treatment
2. Application of Plasma Surface Treatment
3. Example of Plasma Surface Treatment in Electronics Industry
4. Summary
5. Q&A



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Current Challenges in Electronics, Semiconductor and Sensor Industry

- Demands for **perfect surface characteristics** (cleanliness, adhesivity, coating, etc.)
- Use very **aggressive chemicals** (non-environmental friendly) to achieve desired surface effects
- Treatment of **thermally sensitive** materials
- Treatment on places that cannot be reached by mechanical treatments or liquid chemical compounds such as in **cavities, undercuts and gaps**



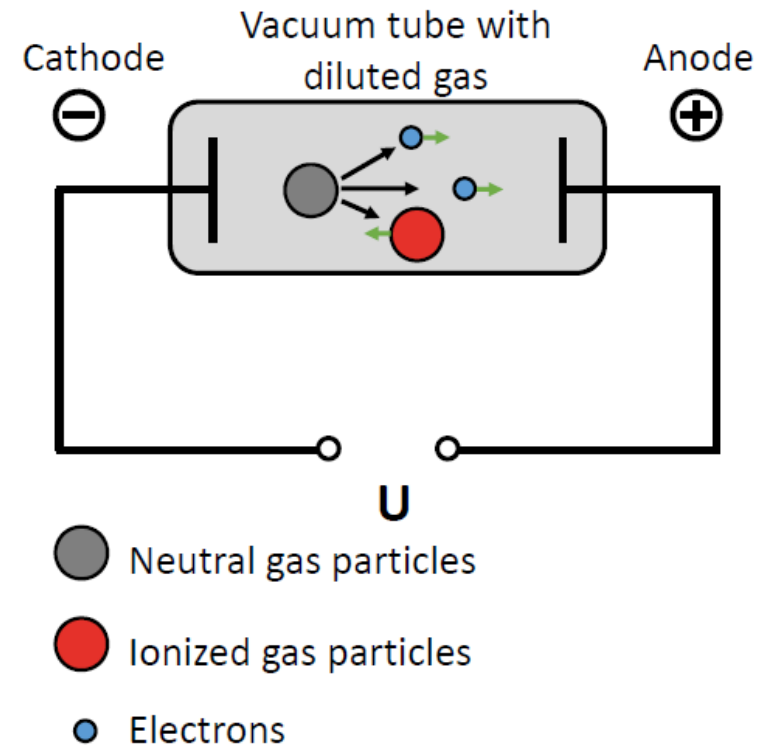
What is Plasma?

- Fourth State of Matter
Solid \Rightarrow Liquid \Rightarrow Gaseous \Rightarrow Plasma
- Charged particles and Neutral particles (anions, cations, electrons, radicals, etc.)
- Charged particle can move freely in space and interact with electromagnetic fields
- Natural plasma: Lightning, polar lights and the sun
- Artificial plasma: Neon light, plasma globe and flash bulbs



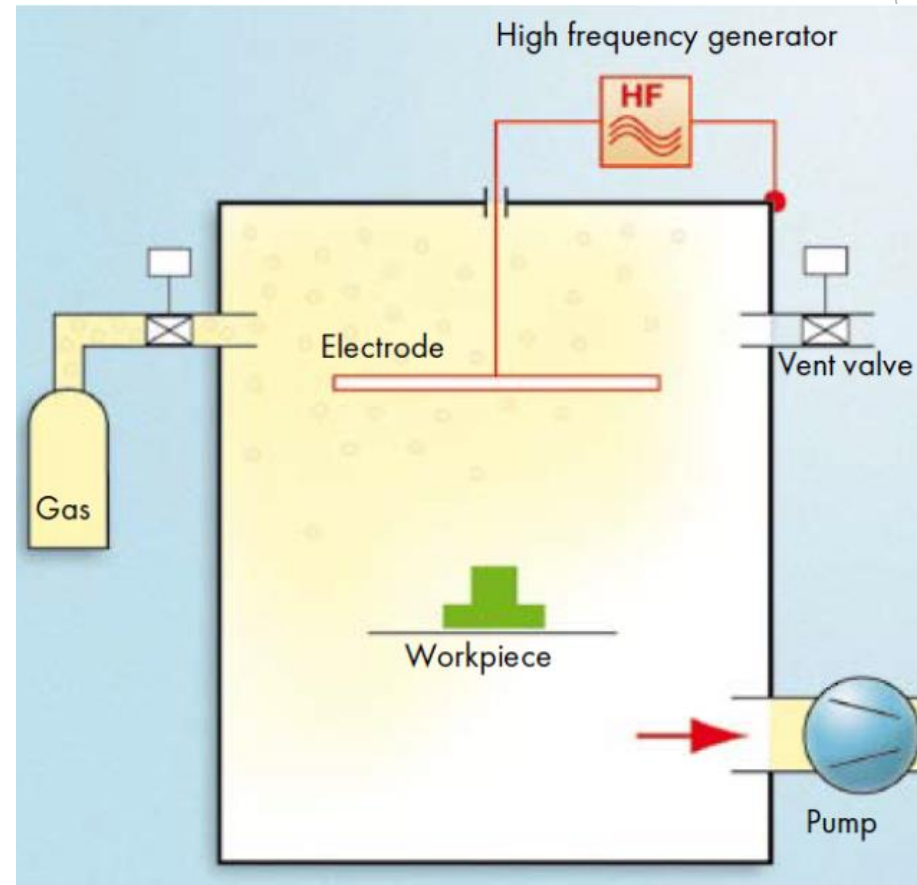
How is Plasma Generated?

- Vacuum pressure < 1 mbar (Atmospheric ≈ 1000 mbar)
- Highly diluted gas
- Increased mean free pathway \rightarrow Particles travel a farther distance before colliding
- Gas can be easily ionized / generated



Low Pressure Plasma System

- Vacuum Chamber
- Vacuum Pump
- High Frequency Generator
- Process Gas or Chemicals (air, oxygen, argon, CF₄, SF₆, argon-hydrogen, acetone, fluorinated chemicals)
- Control and Monitor System

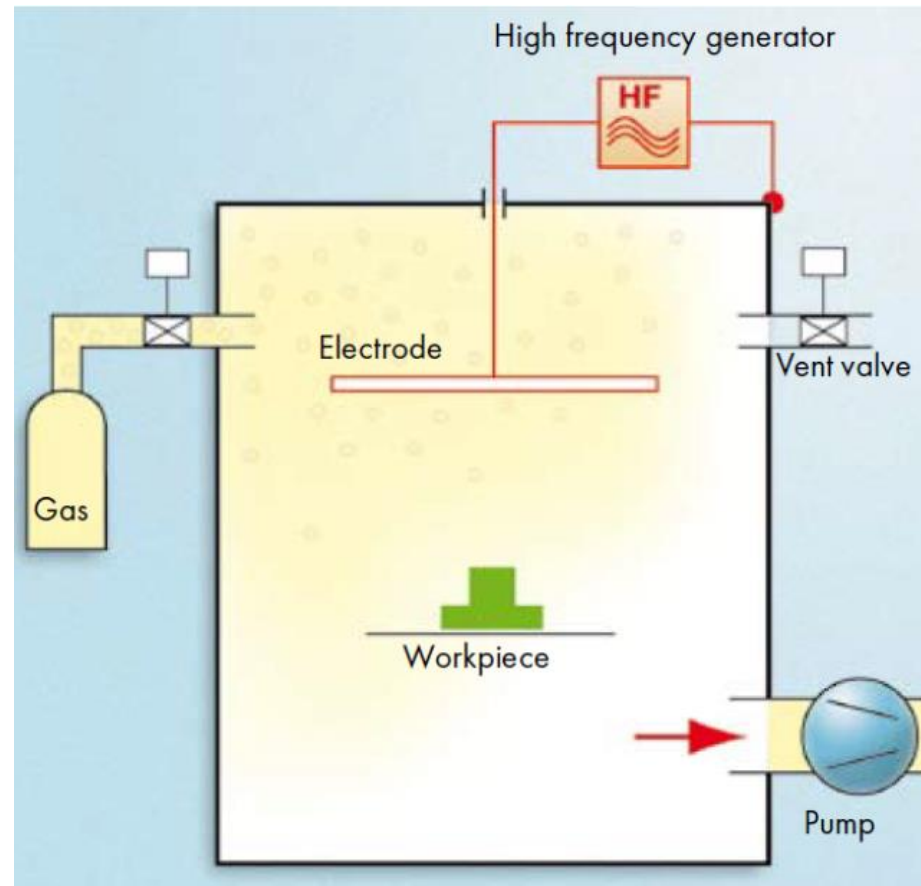


Plasma Surface Treatment Process



Plasma Surface Treatment Process

- i. Place the workpiece
- ii. Vacuum the chamber
- iii. Process gas introduced into chamber
- iv. Process gas ionized
- v. Ventilation
- vi. Process ends





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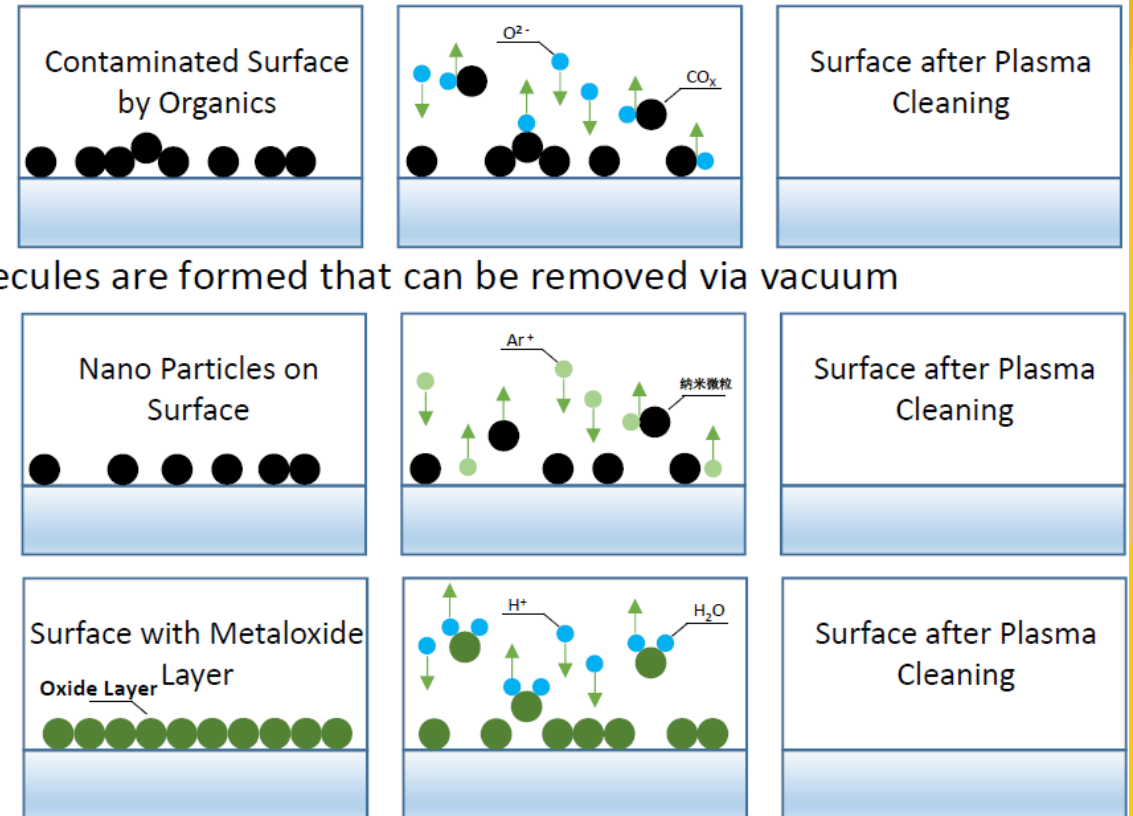
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Application of Plasma Surface Treatment



Application of Plasma Surface Treatment

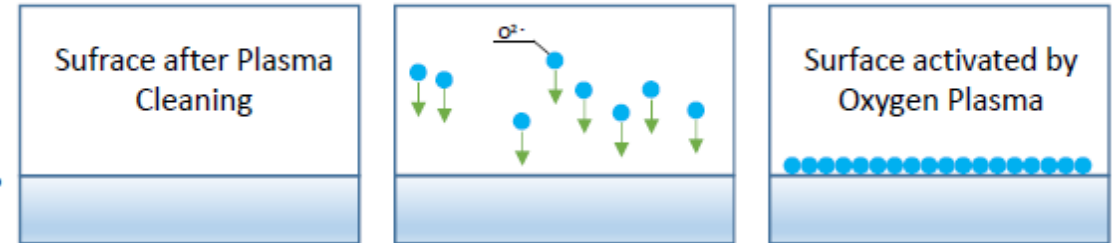
- **Cleaning** • **Removal of Organic Contaminants**
 - Oxygen / Air
 - Chemical reactions where stable molecules are formed that can be removed via vacuum
- **Activation**
- **Etching** • **Removal of Nano Particles**
 - Argon
 - Physical Bombardment
- **Coating**
- **Reduction of Oxide Layers**
 - Hydrogen
 - Chemical Reaction with Oxide Layers





Application of Plasma Surface Treatment

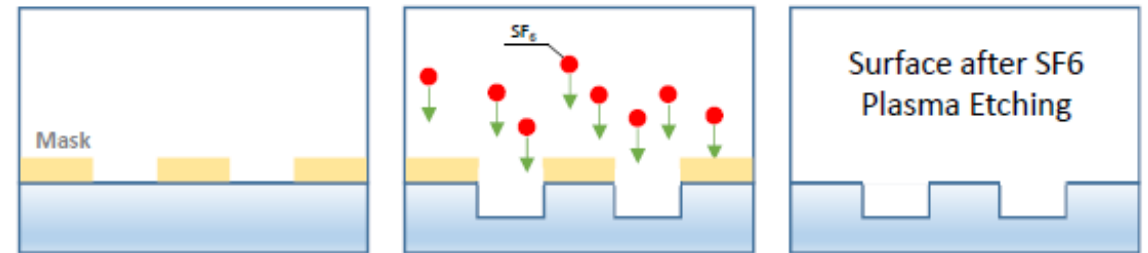
- **Cleaning** • Free radicals which are generated in plasma will be grafted on surface. Surface free energy is increased after plasma activation.
- **Activation**
- **Etching** - Oxygen / Air
- **Coating** • **Removal of Metaloxide Layers.** Surface free energy has been increased.
- Hydrogen





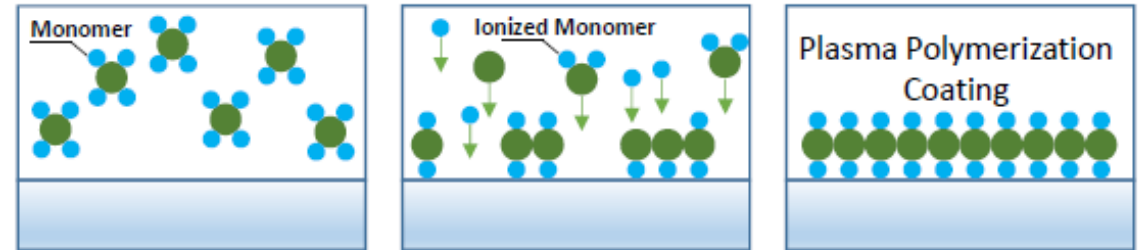
Application of Plasma Surface Treatment

- **Cleaning** • **Dry Etching in Photolithography process. Ionized gases react with target materials. Surface will be structured after etching.**
- **Activation**
- **Etching**
 - O₂, Ar, CF₄, SF₆, etc.
 - Physical and Chemical Etching
- **Coating** • **Increase surface roughness by increasing surface area.**
 - H₂, Ar, CF₄, etc.
 - Physical and Chemical Etching



Application of Plasma Surface Treatment

- **Cleaning**
- **Activation**
- **Etching**
- **Coating**
 - **Plasma Polymerization Coating.** Monomers are introduced into the vacuum chamber and deposited on the surface to have polymerization reaction.
 - Hydrophobic Coating
 - Hydrophilic Coating
 - Protection / Barrier Coating
 - Self-lubricate Coating





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Example of Plasma Surface Treatment in Electronics Industry

Consumer Electronics

- Assembly of Mobile Phones
- Production of Glass Screen
- Assembly of Tablet and Pad
- Assembly of PC and Server



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PlasmaBeam

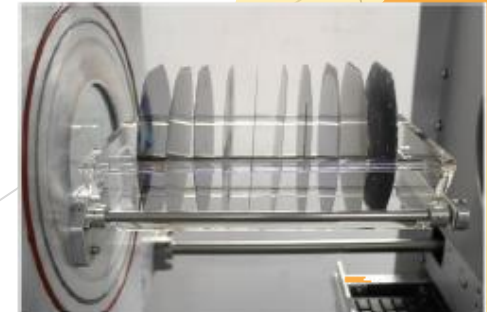
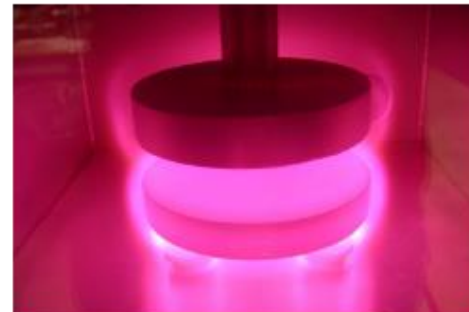
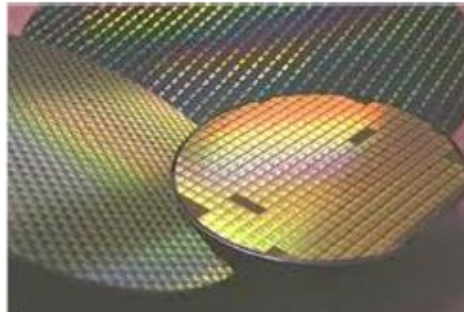
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Example of Plasma Surface Treatment in Electronics Industry

Semiconductor

- Wafer Cleaning
- PECVD
- Patterning
- Removal of Photoresist
- Bonding
- Packaging in SEMI



Example of Plasma Surface Treatment in Electronics Industry

Electronics and Sensor Production

- PCB Cleaning
- Sensor Production and Packaging
- Electronic Parts Cleaning and Protection
- Failure analysis





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How does a Plasma System look like?

Low-pressure plasma



In the low-pressure plasma technology, gas is excited in a vacuum by supply of energy. This results in energetic **ions and electrons**, as well as other **reactive particles** which constitute the plasma.

Atmospheric pressure plasma



With **atmospheric plasma technology**, gas is excited by means of a **high voltage at atmospheric pressure** in such a way that a plasma is ignited. The plasma is expelled by **compressed air** from the nozzle.

Diener Electronic

- Headquarters in Baden-Württemberg with >100 staff employed
- Offers complete range of **Atmospheric** and **Low-Pressure Plasma Systems** in all sizes and for all areas of technology
- Produces all systems entirely **in-house in Germany**
- **R&D Laboratory** and **Technical Laboratory** for continuous development and optimum surface analysis and support to customers
- To guide your project to success, we offer:
 - ✓ **Comprehensive consultation**
 - ✓ **Process development**
 - ✓ **Technical training**
 - ✓ **On-site commissioning & After-sales maintenance**

■ Made
■ in
■ Germany



Who trust Diener's Plasma Surface Treatment System?





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Summary

- ✓ Plasma treatment has been widely used as a means of **engineering the surface properties** of various materials/components
- ✓ The four key effects of plasma:
 - **Cleaning**
 - **Activation**
 - **Etching**
 - **Coating**are proven for processes improvement such as ion-planting, de-oxidation, adhesion, coating, isotropic/anisotropic etching, cleaning, patterning, barrier insulation, etc.
- ✓ **Cost-effective** method compared to other techniques in surface treatment



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Q & A



For more information, please contact:

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