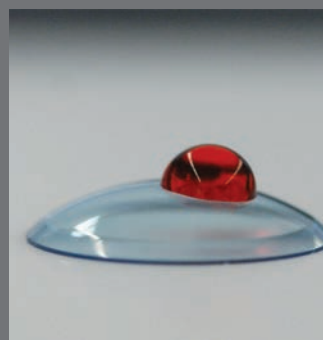
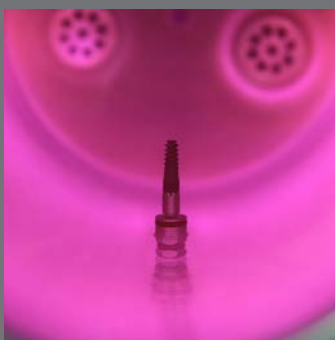
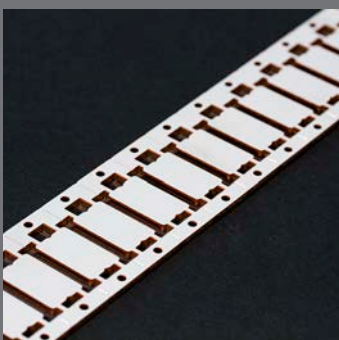
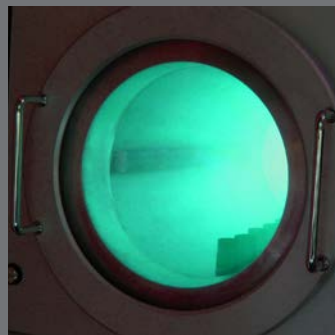


Plasma Surface Technology



Plasma Technology – New Surfaces on Every Material

What are the uses of technical plasma?

Technical plasma is capable of generating almost any **surface characteristics** to any materials:

Plasma removes **organic residue** from all **surfaces**.

Plasma treatment increases **surface energy** to improve the bonding of any materials. All **surfaces** can be **etched in plasma**, in a way that very fine structures with nanometre-level precision can be created.

Surfaces of any material can obtain extremely **hydrophobic** or extremely **hydrophilic** properties.

Super thin invisible **coatings** created in **plasma** provide protection, are **abrasion-resistant**, **self-lubricating** and **optically functional**.

Diener electronic:

- Experience with over 6000 **low-pressure plasma systems** and 2000 **atmospheric-pressure plasma systems** since 1993
- Applications and experience in all industrial sectors and fields of research
- Technical solutions and systems for all **plasma technology** applications
- Fully equipped with an analytical **laboratory, clean room** and pilot plant for **process development**
- Comprehensive service
- Solutions for every component geometry and size



Drops roll like beads off a surface made **hydrophobic** by **plasma** coating.

Plasma: the fourth state of matter

Almost any substance is solid (frozen) when the temperature is low enough. When energy is added (heating), it becomes liquid. When heated further, it becomes **gaseous**. When even more energy is added to a **gas**, it causes **electrons** to separate from **molecules** and **atoms**. The result is a plasma.

Solid - liquid - gas - plasma

Gas particles become **ionised**, i.e. positively charged.

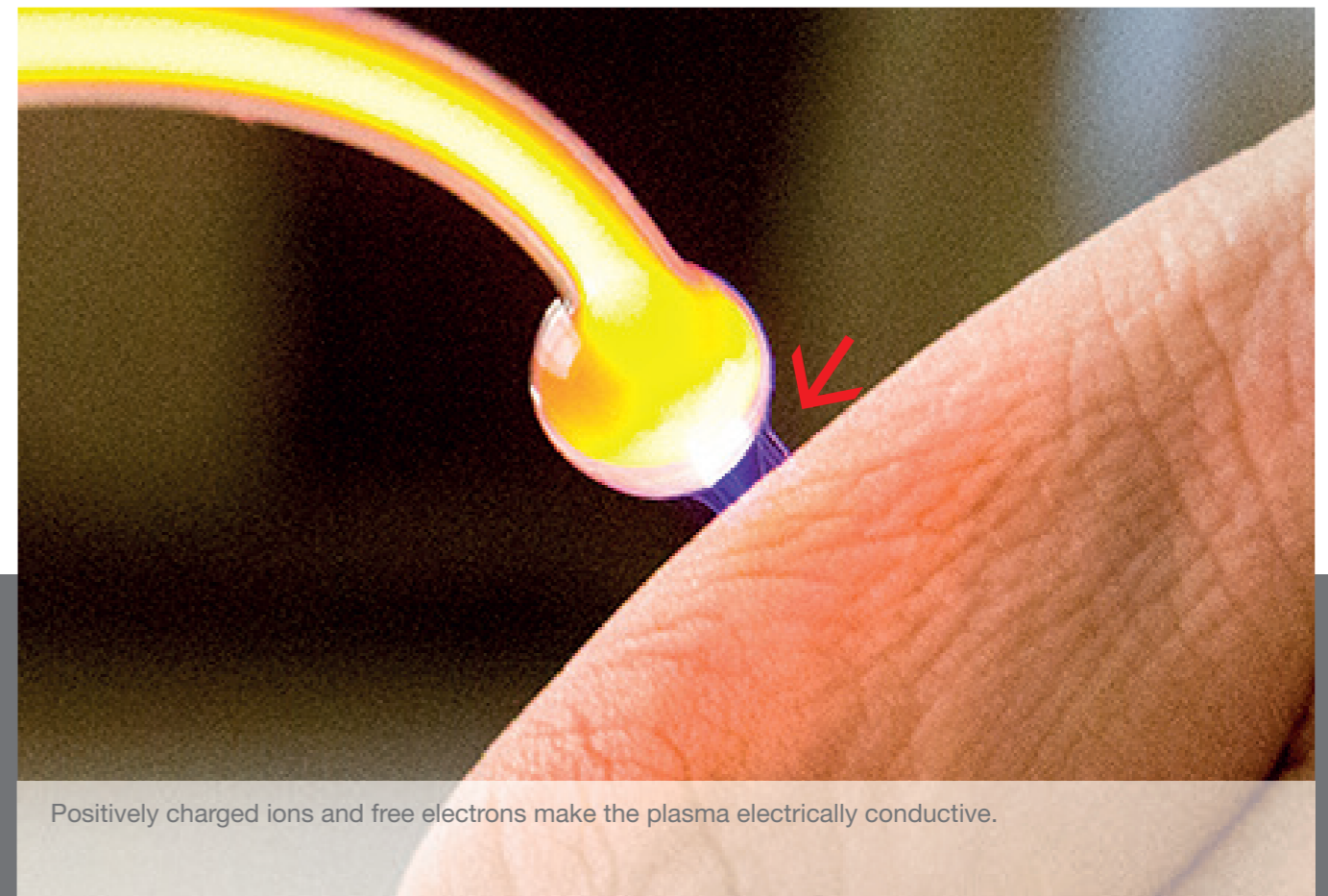
It is not only possible to add the necessary energy with an increase in temperature, but also with high-energy radiation or **electrical stimulation**.

Plasma seems exotic to us. It was only discovered in 1928 (by **Irving Langmuir**, who also named

it). And yet, 99% of the **universe** is made up of **plasma**, in particular all active stars. On Earth, natural plasma is only present

- in lightning
- in auroras

From a technical point of view, it is actually relatively easy to produce plasma.



Positively charged ions and free electrons make the plasma electrically conductive.

How Plasma Technology Works



Technical plasma reacts every time

Almost all of the matter in the sun and stars is **ionised**, whereas it is always only a small portion in **technical plasma**. Usually less than 1%. However, many parts work together during a **plasma treatment**:

- Positively charged **ions** where a free electron has separated from the **atom (molecule)**
- **Excited atoms** where the electrons have not left the atom, but were excited to a higher energy level

- Ionising **UV radiation**, which is produced when an ion recaptures a **free electron** and becomes a **neutral atom** again
- **Radicals**: Molecular sections that were separated by **ionising UV radiation**

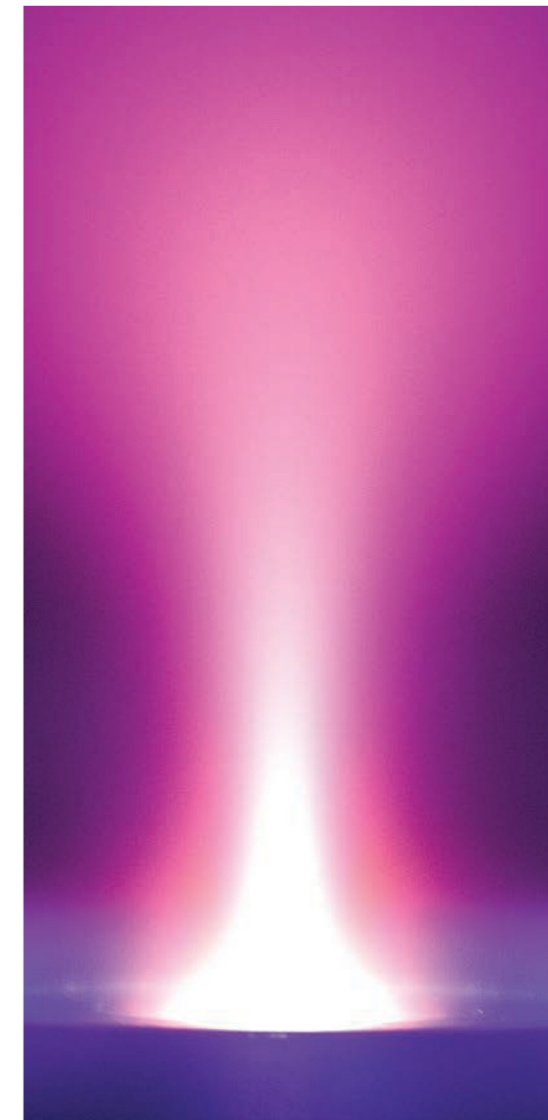
All of these "**active species**" are highly **reactive**, i.e., they react strongly with matter, even if it would otherwise be inert. Plasma thus works on all substances.

Technical plasma is **excited** electrically. This is done using either **high voltage** or **high-frequency electrical fields**.

Plasma exposed to the open atmosphere **Atmospheric-pressure plasma**

In a strong electrical field, the positive and negative charge concentrations in the atoms are pulled far apart. This can cause electrons to be torn out of the atomic compound. Here is how high-voltage discharge under atmospheric pressure works:

The active species react very rapidly with other particles at atmospheric pressure. As a result, the throw distance is shorter. At atmospheric pressure, the plasma achieves expansion in



The colour of plasma:

Even mundane technical plasma is fascinating due to its mystical luminous colour. This radiation is created by the energy emitted by atoms when they return from an excited state to their ground state. Because the electrons in the atom can only populate certain "discrete" energy levels, the same amount of energy (specific to the gas) is released every time an energy jump occurs. This is why each gas glows in its own typical colour.

This is only possible with plasma technology

- There is no material that cannot be treated with technical plasma. This means that **non-polar plastics** and even **PTFE** become suitable for **gluing**.
- It is usually necessary to use very aggressive chemicals to achieve comparable **surface effects** by other means. **Plasma treatment does not have any negative impact on the environment**. The aggressive media are only present within the plasma. Once the plasma is switched off, they are gone.
- Plasma treatment only affects the surface. **Thermally sensitive materials** and **living things** can therefore be treated as well (seeds, human body).
- **Plasma treatment is efficient**. No expenses for the storage and disposal of chemicals, protective measures, the removal of etching agents, or drying.
- **Plasma treatment** also works in places that cannot be reached by mechanical treatments or liquid chemical compounds, such as in **cavities, undercuts and gaps**.
- Thanks to plasma's ability to work with atomic precision, structures with clearances of less than a **micrometre** can be produced and treated. Likewise, it is possible to produce or remove **closed layers** in such dimensions.

Plasma in the vacuum chamber

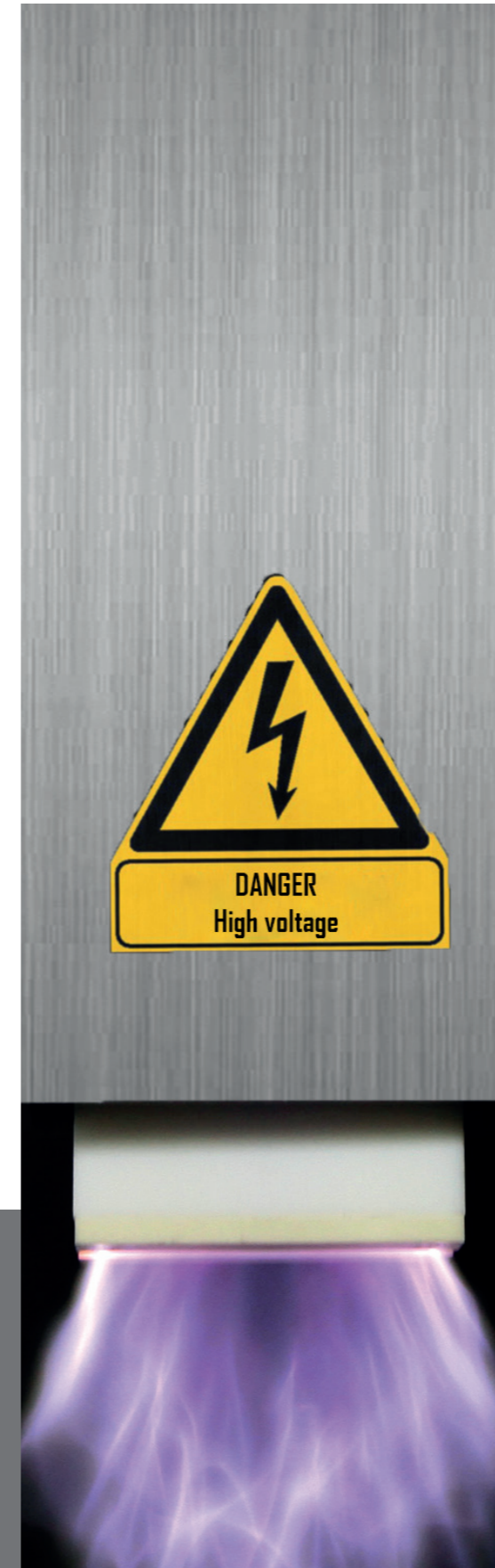
Low-pressure plasma

In a high-frequency electrical field, low voltage is sufficient to excite the plasma. In low frequency and radio frequency ranges (kHz to MHz), excitation occurs between two electrodes. Often the stainless steel housing of the vacuum chamber serves as one of the electrodes.

A magnetron is used for excitation in the microwave range (GHz). The long free throw distance of the active species allows the plasma to fill the entire chamber.

Plasma Systems

Atmospheric Pressure Plasma System APC 500 (Corona Method)



Diener electronic covers all your needs

Diener electronic offers solutions to any surface problem. While our competitors specialise in specific aspects of plasma technology, Diener electronic has experience and offers answers for all fields where surfaces are treated.

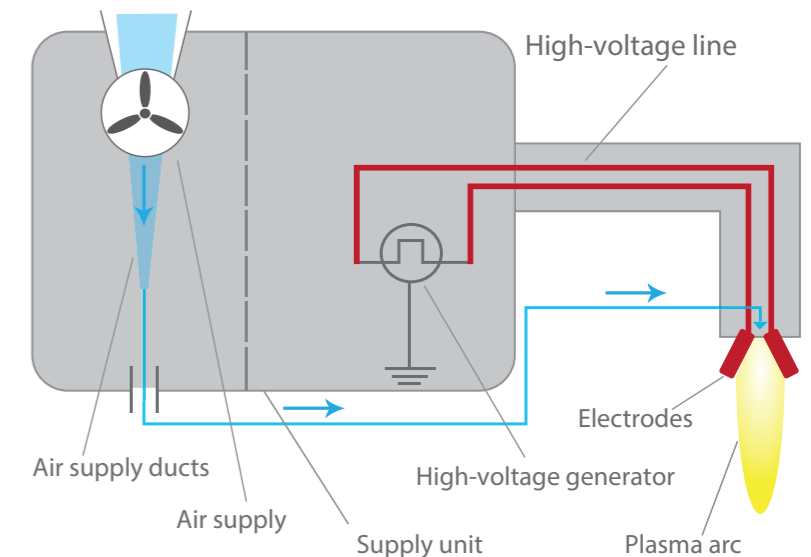
...or we invent a solution for you

- Diener electronic was the first manufacturer to mass produce **low-pressure systems with low-frequency (LF) excitation**, which dominate in many areas of technology today.
- If there is no standard-system to meet your expectations, we will develop it. More than any of our competitors, we have optimised our production in such a way that we can build **special systems** quickly and efficiently for any application.

Atmospheric or low-pressure plasma?

There is no "better or worse" method, but the „appropriate or non appropriate one“.

- Large parts can be treated in low-pressure plasma as well, but there are limits; otherwise the system costs become enormously high. Atmospheric-pressure plasma can treat components of any dimension.
- Any gaseous substance can be used in low-pressure plasma, but only certain gases can be used in the open atmosphere. Certain processes, especially coatings, are therefore only economically efficient at low pressure.
- Atmospheric-pressure plasma works in a highly precise manner. Surfaces must be scanned. This may take some time and does not usually require complex automation. Low-pressure plasma works on the entire surface. Where this is not desired, the surface must be covered.



Cost-effective method for the activation of plastic and elastomer surfaces.

With air under atmospheric pressure as process gas

A gas discharge is ignited in the inhomogeneous field between two electrodes. The voltage is about 10,000 V.

The air flowing through is ionised in the discharge zone.

The plasma is blown out of the electrode region by the airflow. The substrate can be treated in the escaping corona.

A strip measuring several centimetres in width is treated in the corona. Entire surfaces can be treated with multiple parallel plasma generators.

For the activation of pipes, hoses, profiles, sheets and plates made of materials that bond only poorly in preparation for gluing, lamination, painting and printing. The stream of gas is electrically charged and therefore not suitable for conductive substrates.

Atmospheric Pressure Plasma System Plasma Beam (Active gas jet Method)

A **gas discharge** is ignited between a **central electrode and an insulated ring electrode**. A plasma is excited in the **stream of gas** flowing through. The plasma is blown out through the **nozzle**.

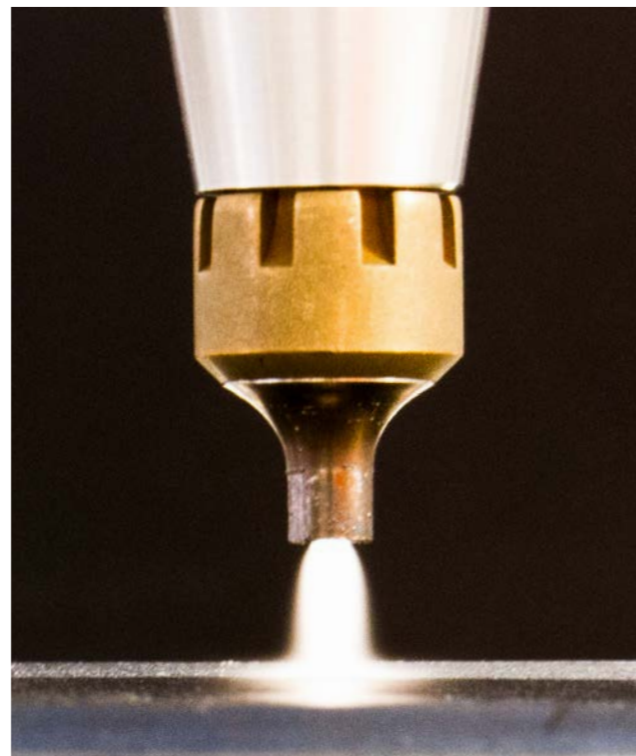
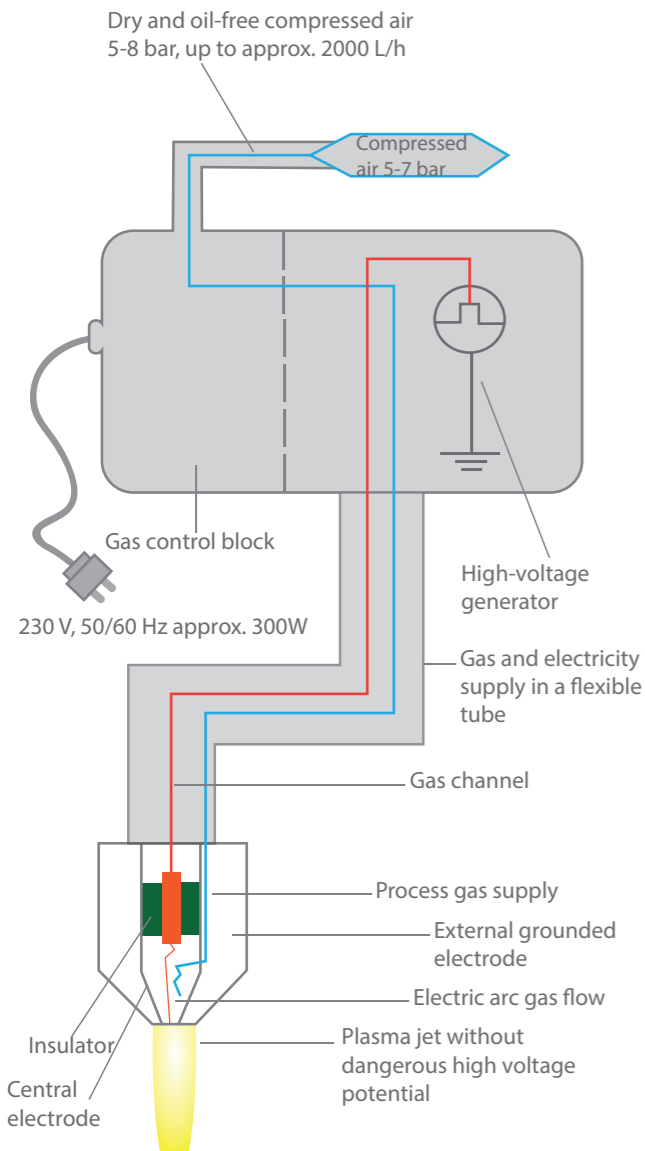
There is no high voltage in the plasma jet. **Metallic substrates** can also be treated. The temperature is relatively high. **Thermally sensitive substrates** can only be treated very briefly in a continuous manner.

The effective treatment spot has a diameter of approx. 10-12 millimetre, but **treatment speed** is

high. The plasma can therefore generally be guided over the substrate quickly.

Handling and robotics systems make it possible to rapidly treat curved surfaces of **any dimensions**.

Atmospheric-pressure plasma system



For precision cleaning and activating substrates of components of any dimension, even endless substrates or individual parts, on a conveyor belt (in-line)

A Wide Variety of Low-Pressure Plasma Systems

• Homogeneous plasma throughout the chamber

All **chamber sizes** of **0.1 L to (currently) 12,600 L** are filled with a **homogeneous plasma**, allowing the entire surface of the component to be treated simultaneously.

Varying effects depending on the excitation frequency

The **alternating electric field** allows the plasma to be excited under low pressure starting at 40 volts. The choice of **excitation frequency** makes it possible to control not only the speed, but also whether the **treatment effects** are dominated by

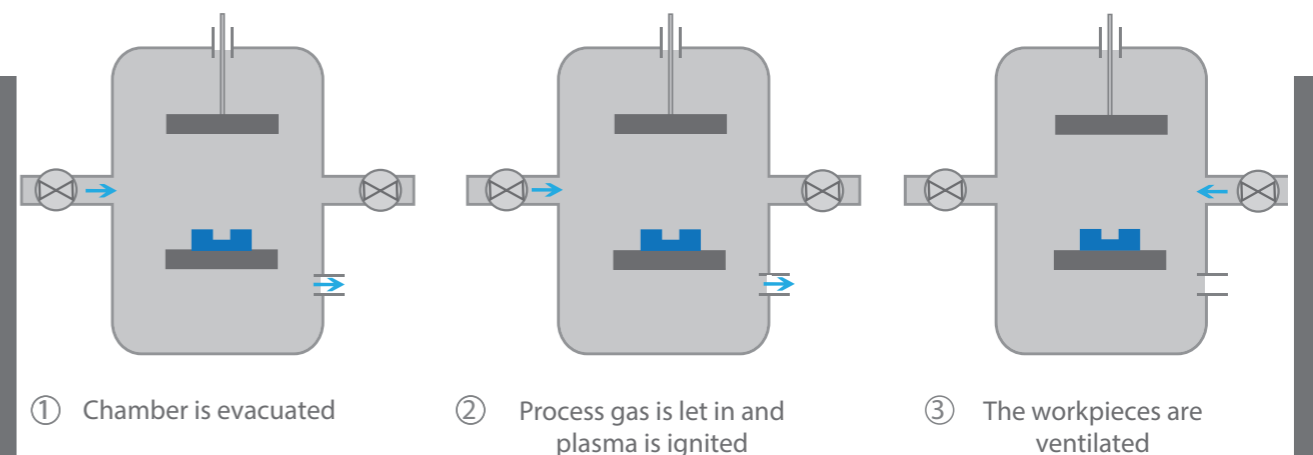
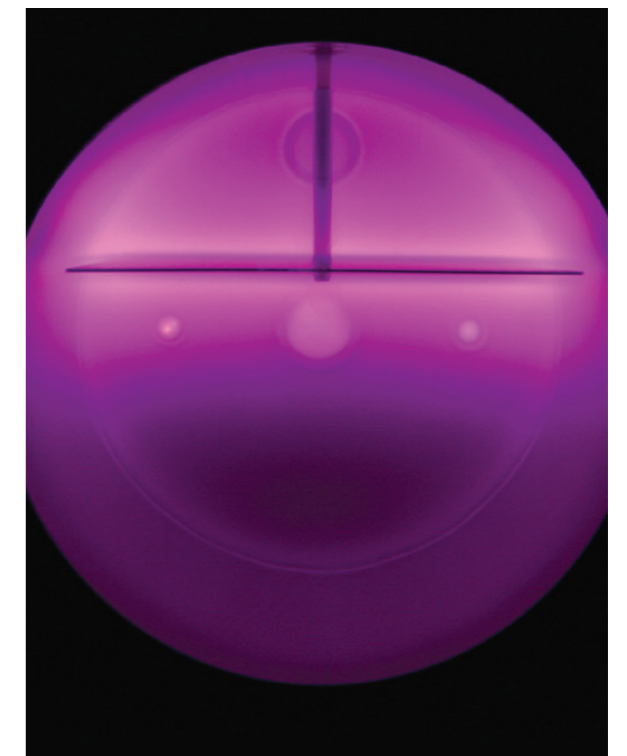
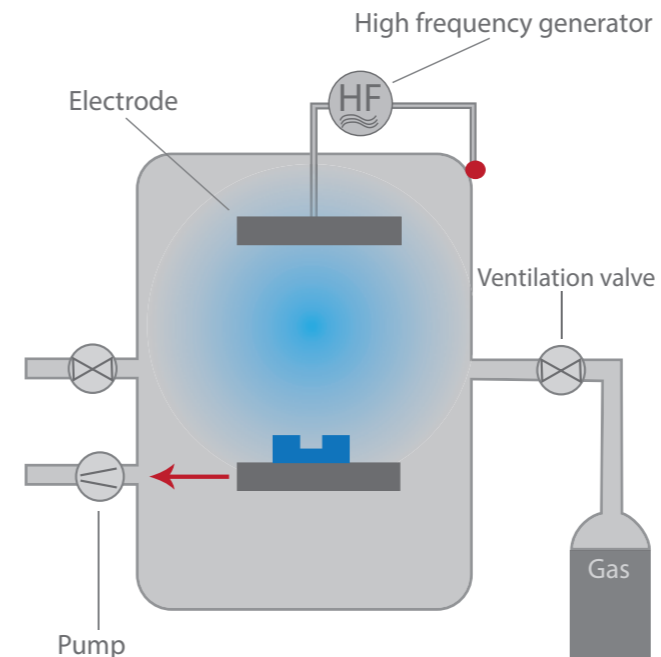
ions, excited atoms, or UV radiation. **Large variety of plasma gases, large number of effects**

Any substance which is gaseous in a **vacuum** can be used as a **process gas**.

Generalists and specialists

Efficient production plants are usually optimised for one treatment method, such as **PlasmaCleaner, PlasmaAsher, etc.** **Laboratory and test facilities** in particular can also be used universally for **cleaning, activation, etching and coating**.

To illustrate the basic principle: Low-pressure plasma system with a high-frequency generator.



Low-Pressure Plasma Technology or Atmospheric Plasma Technology?

Applications and properties	Advantages of low-pressure plasma	Disadvantages of low-pressure plasma	Advantages of atmospheric-pressure plasma PlasmaJet (plasma nozzle method)	Disadvantages of atmospheric-pressure plasma PlasmaJet (plasma nozzle method)	Advantages of atmospheric-pressure corona	Disadvantages of atmospheric-pressure corona
Plasma generation in general	Plasma is evenly distributed inside a plasma chamber. Chamber volume varies from 0.1 to 12,600 litre (other sizes can be ordered)	Complex vacuum technology. In-line plasma treatment applications are limited.	Plasma treatment can be realized directly at the conveyor belt. Suitable for in-line. No vacuum technology required	The plasma treatment track is limited due to the plasma excitation principle (approx. 8-12 mm). More nozzles must be used or the nozzle must be moved for the treatment of larger objects.	Plasma treatment can be realized directly at the conveyor belt. Suitable for in-line. No vacuum technology required.	Only suitable for non-conductive substrates. Relatively low treatment rate compared with atmospheric-pressure plasma (plasma nozzle method).
Treatment of metals	Oxidation-sensitive objects can be cleaned with plasma. (e.g. H ₂ as process gas)	The energy can be coupled to the objects by microwave excitation. This causes overheating of the object. With kHz plasma no overheating is observed	In plasma treatment of aluminium, very thin oxide layers (passivation) can be generated	In plasma treatment of copper, thin oxide layers can be generated	No applications	Not possible
Treatment of polymers/ elastomers	Plasma activation of PTFE is possible (etching process). Good plasma processes for elastomer and PTFE seals have been developed and are in use	Some materials (e.g. elastomers) require larger pumps to achieve the required process pressure	Pretreatment of "endless" objects is possible (e.g. hoses, cables, etc.). Very short process time	Plasma jet has a temperature of approx. 200-300 °C. Process parameters must be well adapted to the surface to avoid melting (thin materials)	Pretreatment of "endless" and wide objects (up to 60 mm) is possible	Relatively low treatment rate compared with atmospheric-pressure plasma. The treatment uniformity and the surface energy are somewhat lower in comparison with atmospheric and low-pressure plasma
3-D objects	All objects in the plasma chamber are treated equally. Even cavities can be treated from the inside (e.g. ignition coils, water tanks, etc.)	Not known	Local surface treatment is possible (e.g. adhesive groves)	Elaborate articulated robot technology is required. Gap penetration properties of atmospheric-pressure plasma are limited	Only conditionally suitable. Very poor gap penetration properties	Elaborate articulated robot technology is required. Gap penetration properties of the corona plasma is very limited
Bulk material items and powder	Rotary drum method allows uniform plasma treatment of bulk material items. The number and volume of parts may be variable	Only approximately 1/3 of the rotary drum volume is used (recommended)	E.g. the powder can already be activated "as it passes by"	Strong airflow blows the small parts away.	The treatment of bulk material items in conjunction with a rotary drum is possible. The parts can be treated directly on a conveyor belt.	Reduced treatment intensity compared with low-pressure plasma. Strong airflow blows the small parts away.
Electronic/semiconductor technology	Plasma treatment of electronic components, circuit boards and semiconductor parts by means of low-pressure plasma is state of the art.	Not known	Plasma pretreatment of metal or ITO contacts must be implemented immediately before the bonding process (e.g. LCD, TFT and chip production)	The assembled PCB surface can only be reached to a limited depth.	Not possible due to direct high-voltage discharge.	Not suitable due to high voltage potential
Coating processes	Production of uniform coatings. Many PECVD and PVD processes have been developed and are applied. There are many applications used in industry	Plasma chamber can be contaminated by the polymer layer	In-line coating possible	Requires a great deal of maintenance. Dust and nano particles formation.	Not possible	Not possible

No Industry Without Plasma Technology

- **Precision cleaning of organic residue with oxygen plasma** is a precondition for any further treatment in all industries.
- In the field of **optics**, scratch-proof and optically active coatings (polarising, anti-reflective, etc.) are applied using plasma coating.
- In **precision technology**, gear parts are given a wear-resistant coating and bearings become epilaminated.
- There are numerous applications in the **electronics industry**:
 - Etching, structuring, ion implanting of semiconductors
 - Etching of masks used in **photolithography** for applying **conductor tracks, photoresist ashing**
 - Deoxidation** of conductor contacts.
 - Hydrophobic protective coating** on circuits or entire devices
- **Automobile industry**:
 - Activation of plastic components** before **painting and gluing** and of interior parts before **flocking** and much more

Elastomer technology
Precision technology
Semiconductor technology
Electronics
Laboratory equipment
Optics
Sealing technology

A Few Examples

Textiles

Plastics

Medical technology

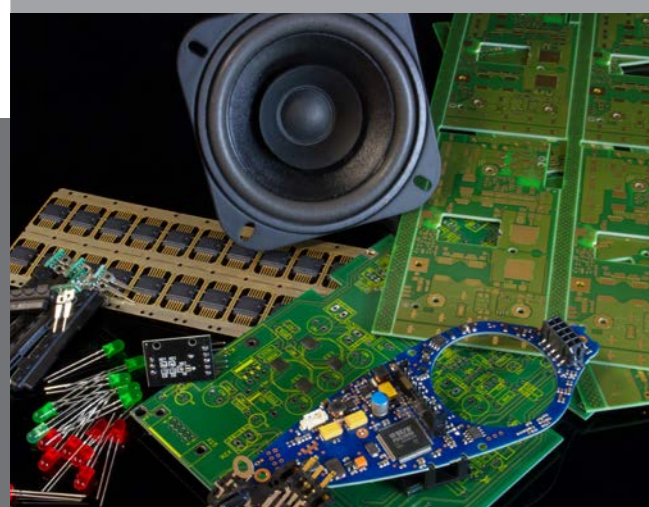
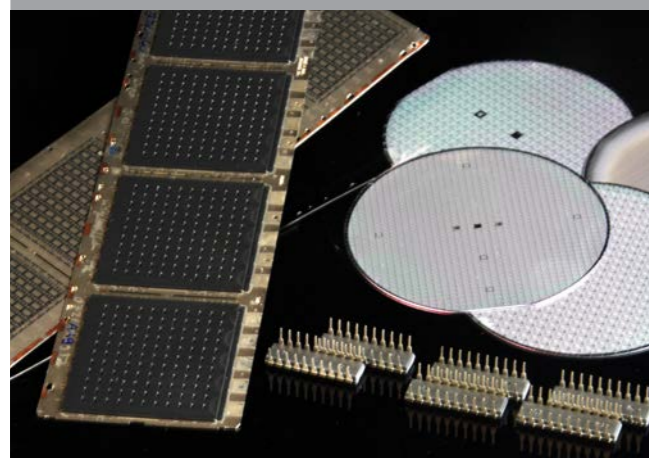
Automobile industry

Biotechnology

Research

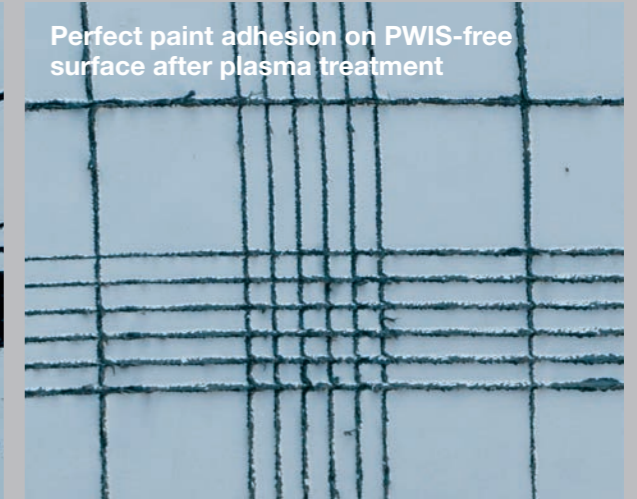
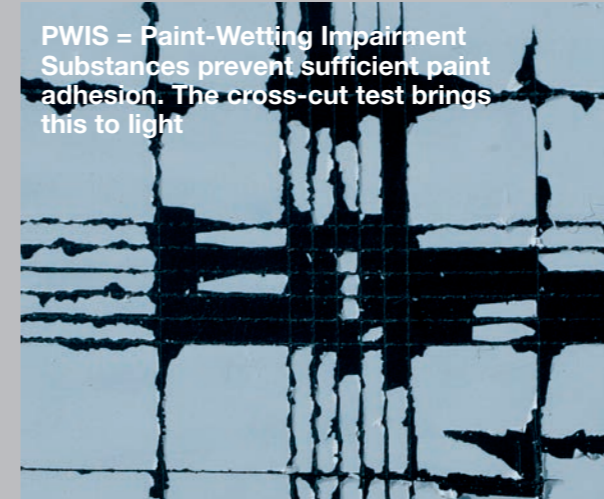
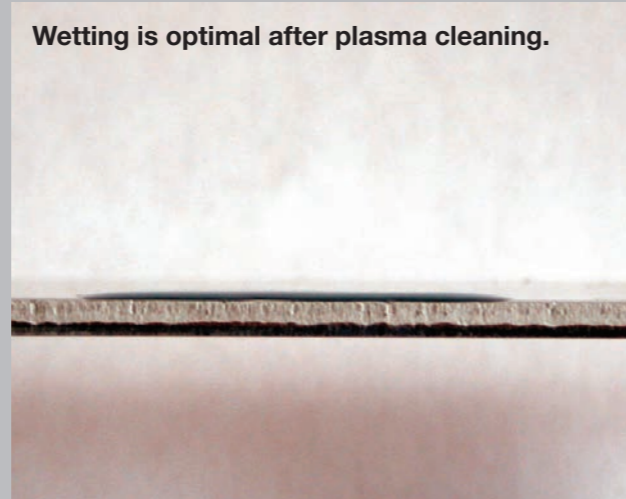
- **Jewellery, design:**
Hydrophobic, self-cleaning surfaces (**anti-fingerprint**)
- **Medicine:** Activation and etching of **implants** for bio-integration, anti-adhesive coating for enhancing flow in **cannulas** and **tubing**
- **Space travel**
- **Laboratory equipment:**
Micrometre-scale etching of **micro-fluidic components, LOC**, hydrophilic coating of **microtiter plates**
- **Plastics:**
Activation and etching of non-polar plastics before printing, gluing and coating
- **Textiles:**
Waterproof hydrophobic functional textiles, water-permeable hydrophilic filtration textiles, composite optimisation of reinforcing fibres

Diener electronic has produced all of these applications and many more.



Areas of Application: Cleaning

Activation



Plasma precision cleaning: A prerequisite for perfect adhesion

Organic residue can be found on even the cleanest surfaces. **Release agent residue** is present on components that have just rolled off the production line, and even short-term exposure to the surrounding air leads to **deposits from the atmosphere**. Wet chemical cleaning will not remove these deposits from cavities and narrow gaps. Moreover, it pollutes the environment and often damages the substrate itself.

Plasma cleaning removes all organic residue from any material.

Applications

- For all surfaces that need coatings, adhesive bonds, paint finishes or ink patterns to adhere

Components

- **Low-pressure plasma** does not harm the substrate chemically or thermally. As a result, practically any solid materials can be cleaned in plasma.

Users

- All those who require high-quality connections, adhesive bonds, coatings, ink patterns or paint finishes

Inorganic residue

- **Micro-sandblasting** can remove any inorganic residues that is hard to remove by other means. Bombardment with high-energy argon ions can be used on any coating (non-selective).

Oxide layers

- Perfect adhesion and **perfect electrical contact** require clean metal surfaces. Plasma treatment removes oxide layers.

Even perfectly clean surfaces can have poor adhesive qualities due to a material's low **surface energy**. **Non-polar plastics**, in particular bulk plastics like **PP, PE, POM**, are affected the most. Plasma treatment in **oxygen or air plasma** creates **polar binding sites** and **increases the surface energy**.

Applications

- All substrates with poor adhesion properties to be bonded, coated, painted or printed on.
- Finishing of plastic components

Multi-component injection moulding, K&K and encapsulation of inserts

Creates an **adhesive bond** on components which could not be connected previously

Applications

- Multi-component plastic parts
- Rubber/plastic connections
- Film lamination
- Plastics bonded to other materials
- Flocking

"difficult to bond" materials

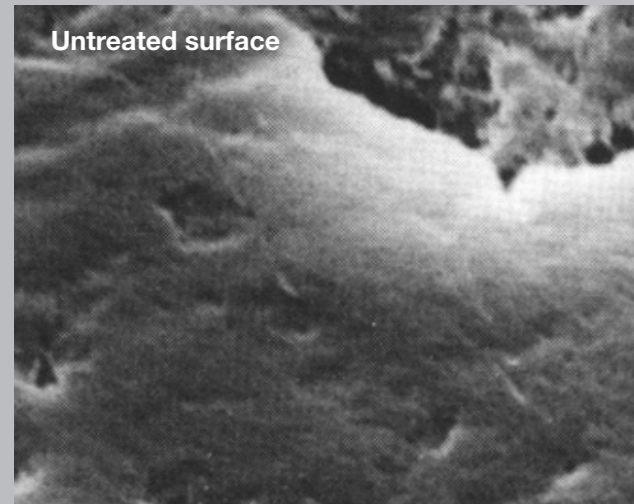
- Plasma activation makes it possible to bond any material, even PTFE.

Where is plasma technology applied?

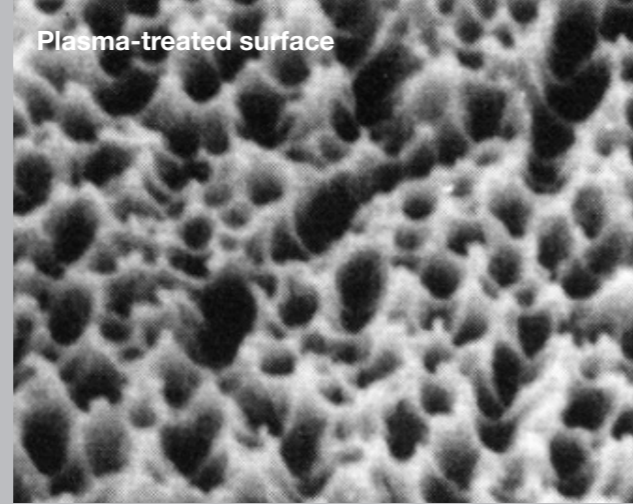
Wherever surfaces are to be modified in a targeted and effective manner.



Etching



Untreated surface



Plasma-treated surface

Plastics and semi-conductors

Plasma technology makes anisotropic and isotropic etching possible: **Isotropic etching by means of chemical multi directional etching, anisotropic etching by means of physical etching** (ion etching approach the surface approx. from one direction), as well as (RIE = Reactive Ion Etching).

Isotropic etching is made possible by polymeric degradation and chemical reaction on organic materials.

Anisotropic etching by ion bombardment is generally effective on any substrate.

Applications for isotropic etching

- **Nanostructuring** of surfaces for surface enlargement and **improved adhesion**
- **Etching of PTFE**
- For perfect paint and glue adhesion when

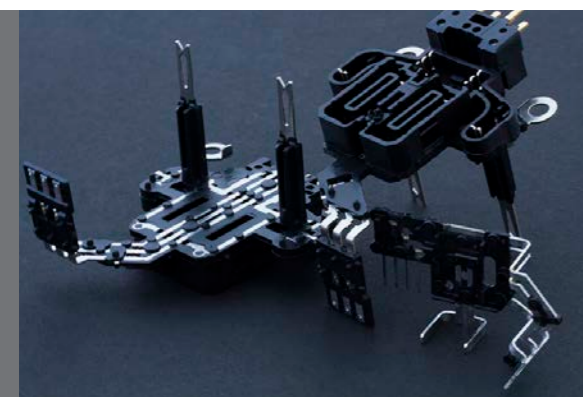
- dealing with difficult connection problems
- Good **bio-integration of implants**
- **Photoresist ashing**
- Removal of **oxide layers**
- Filter ashing for **asbestos analysis**

Applications for an isotropic etching + RIE

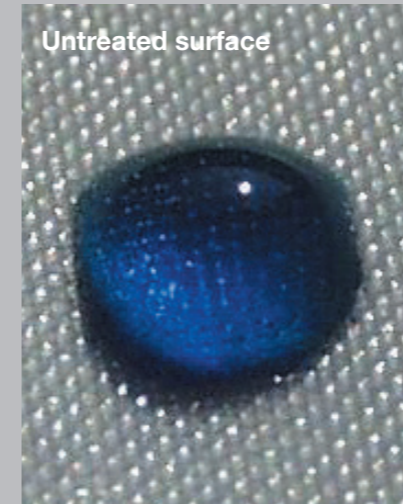
- Etching masks for **printed circuit boards**
- **Micro-fluidic** structures
- **Photolithographic** production of **PDMS** chips and bonding (**LOC** = Lab On-Chip)
- Micro-mechanical components

Users

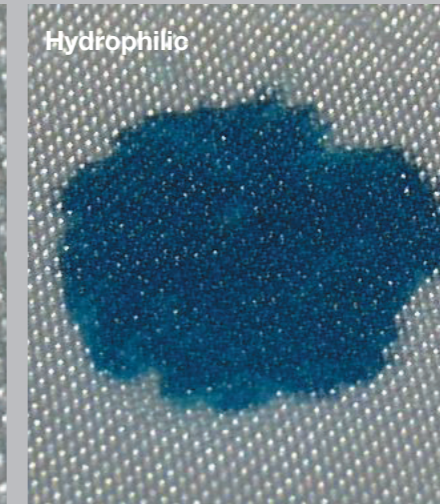
- All areas of **plastics technology**
- **Semiconductor industry, electronics**
- **Laboratory equipment**
- **Research institutes**



Coating Process



Untreated surface



Hydrophilic



Hydrophobic

All technical materials, metals, glass, ceramics and textiles

Plasma coating methods:

There are various coating methods based on low-pressure plasma:

- **CVD (Chemical Vapour Deposition)**
- **DLC (Diamond Like Carbon)**
- **Plasma sputtering**
- **Plasma polymerisation**

The method of plasma polymerisation is of particular importance. **Monomer gases**, which are used as process gases, react to **polymers in the plasma** and are then deposited on the **substrate** as a solid layer. With this method firmly adhering **PTFE-like coatings** can be produced.

Applications

- Depositing **hydrophobic layers**
- Depositing **hydrophilic layers**

- Depositing **protective or insulating layers**
- May be used as a **diffusion barrier**, for example

Components

- High-precision gearboxes
- Chemically polluted components (washers)
- Medical devices
- Optical components (headlamp reflectors)
- Etc.

Users

- Biochip manufacturers
- Precision mechanics
- Appliance manufacturers
- Medical technology
- Sensor manufacturers
- Textile manufacturers and finishers
- Watch manufacturers
- Etc.



Our Services Plasma Systems

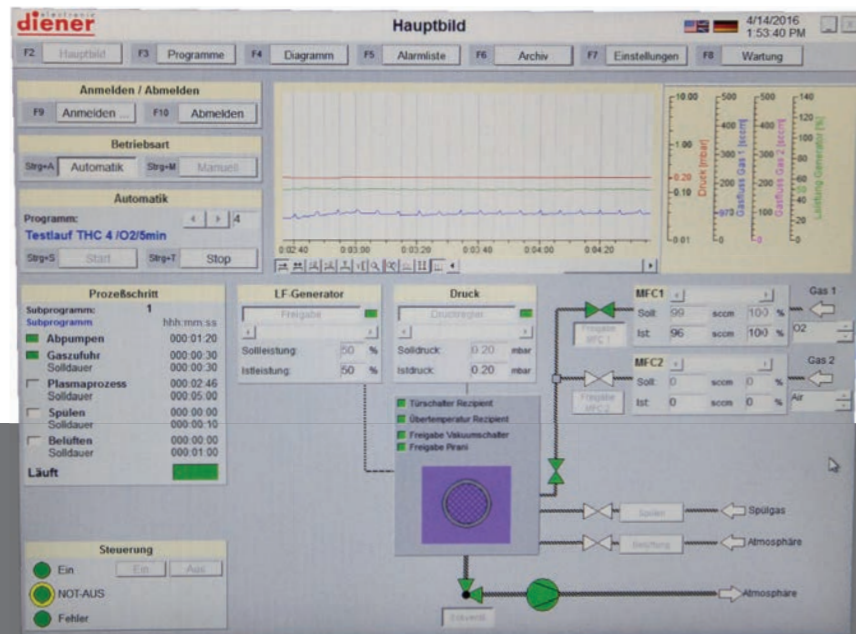
... And Plenty of Support

High level of competence in plasma systems

- Diener electronic produces all systems entirely in-house in Germany.
- Diener electronic produces a complete range of atmospheric and low-pressure systems in all sizes and for all areas of technology.
- Our products do not come „off-the-shelf“. Instead, our production process is designed to ensure a tailor-made solution for every client and every application.
- Our systems are used in every industry and for all applications where plasma technology is required.
- Diener electronic is the market leader in the field of low-pressure plasma systems.
- Diener electronic introduced low-pressure Plasma systems with kHz generators to the industrial market. Thanks to their unproblematic and versatile applications in all industries, these systems dominate the market today.
- Diener electronic manufactures an almost infinite range of equipment options and accessories.

Therefore we will never sell you a solution simply because we have it. Instead we will find the best available option for you and your application.

At the beginning of our cooperation, our support team will look into all the options together with you



To guide your project to success, our support team offers:

- **Comprehensive consultation**
- **Process development**
- **Plasma treatment of sample parts**
- **Technical training**
- **Surface treatment (also in the certified clean room)**
- **Rental systems**
- **On-site commissioning**
- **Maintenance, customer service and spare parts service**

Process development

A member of our project development team will oversee your application from project launch all the way to series production. During that process, our entire range of facilities, including all equipment options, are available to you.

Your project development support person will work with you to determine the appropriate system design and size and the appropriate **process parameters**.

In order to test the results, we have a **fully equipped laboratory with highly modern equipment for chemical and physical analysis**.

Our strengths lie in the competent **advice** and individual **care** of our customers.

We are always striving to find the best solution for your specific needs. We do not see ourselves simply as a manufacturer and supplier of plasma systems, but primarily as service partners and **problem solvers** in the field of plasma surface treatment.

With us you "play it safe": test first, then decide.

We will let you know exactly which system is best suited for your application or task. Just to be safe, you can send us your **sample parts** for **free treatment** or ask us to provide you with a **test system**. In addition to this we offer surface analyses as well as the creation of system concepts. Once you have chosen a system, we will support you in commissioning and process development on site.

Call us – we want you to be satisfied with your cruise.

Whether it's before or after you've purchased a system, we are always at your service. If need should be, we have the most important spare parts available in our warehouse. We offer a fast and reliable customer service which is always available to advise and support you in order to ensure a fast re-start of your production.



Surface Treatment Services

- Do you only rarely have parts which need to be treated with plasma?
- Is the shape of your parts so complicated that it is difficult to find a system that would fit your budget?
- Do you lack a clean room for treating your parts?
- Would you like to leave the plasma treatment of your parts to the experts?
- You are not yet ready to invest in your own plasma technology
- Your own capacity for plasma treatment is not sufficient

For all of these cases we offer in-house surface treatment. Experienced and trained staff are available to ensure optimum surface quality of your parts and components.

From the time we receive your parts until we ship them out, we keep in close contact with you as our customer to achieve your full satisfaction.

Our product range

- Tetra 100 layered electrode system in the clean room for parts to be placed on top with clean room requirements
- Tetra 30 rotary drum system in the clean room for bulk material items with clean room requirements
- Pico UHP system in the clean room for very small parts with clean room requirements (Ultra High Purity processes)
- Tetra 600 layered electrode system for parts with dimensions up to 760 mm x 480 mm
- Tetra 5600 layered electrode system for parts with dimensions up to 1980 mm x 1370 mm
- Powder treatment system (Treatment of several tonnes per month possible)
- Roll-to-roll system for rolls with a treatment width of up to 2 m and a roll diameter of up to 1 m....

Clean Room

Various work processes do not allow contamination by airborne particles. These work processes are carried out in clean rooms.

Work with **doped semiconductors** and the treatment of **medical products** and **surgical instruments** in particular all require a high level of purity.

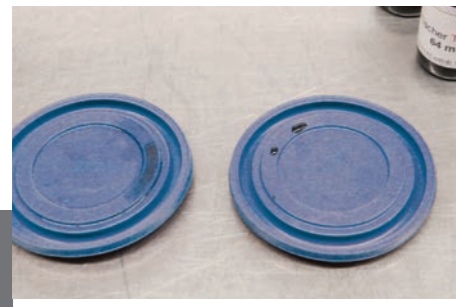
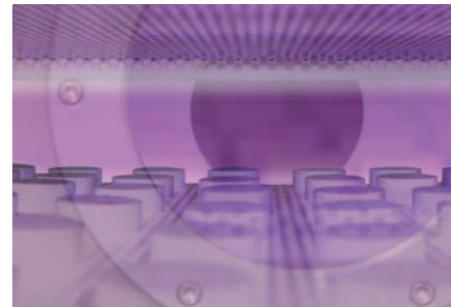
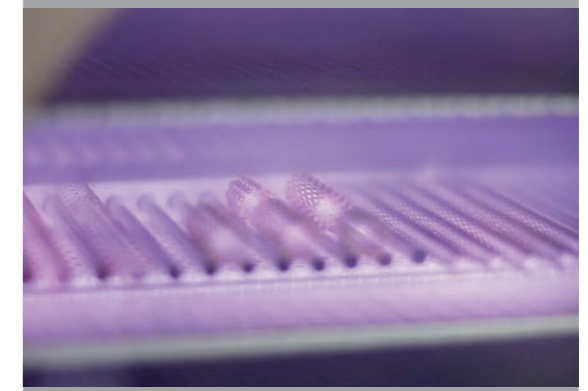
Distinctive features of clean rooms include equipment, air tight/**hermetical partitioning** and ventilation with purified air via ventilation systems which ensure special flow conditions and positive air pressure in the room at all times. For process development and contract treatment of components which are used in semiconductor technology, medicine, chemistry and analytics, Diener electronic has a **clean room certified in accordance with DIN ISO 14644-1**.

Components that are used in surgery, biology and laboratories are plasma treated in the clean room.

The clean room is fully equipped with ESD protection DIN EN ISO 13485:2003 + AC: 2009 and DIN EN ISO 14644-1.



Intertek



Always Optimally Supported Regarding Surface Treatment

Lab

If you exactly know your process, your staff is familiar with the technology of plasma treatment and plasma technology has been introduced at your company:

- You define the required system.
- You place your inquiry.
- You receive our **detailed quotation**.
- You place an order.
- We deliver and put it into service at your company.

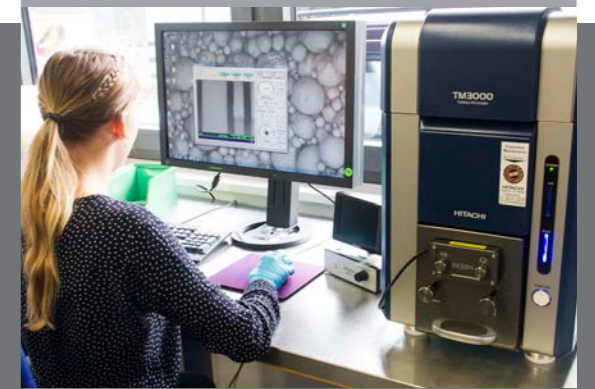
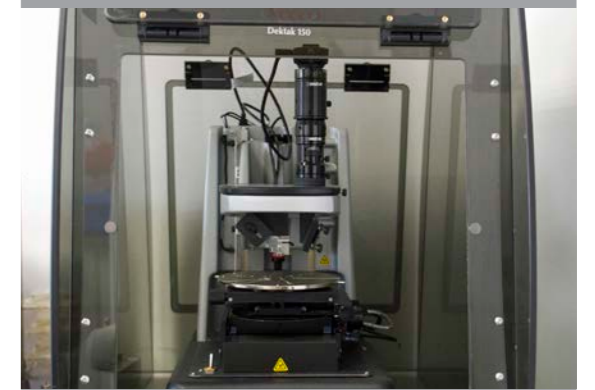
In all other cases:

- We will discuss your application with you in detail.
- We will treat your sample parts in our pilot plant, check the results and optimise the system and process step by step.
- We will help you define the **optimum system equipment** and investigate whether a **rental system** or **contract production** would be an option for you.
- We will oversee your production until optimum results are achieved.
- **Our service team** is always on hand to promptly resolve any technical issues.

- **All facilities for chemical analysis**
- **FT-IR by Perkin-Elmer, spectrometer for surface analysis**
- **Keyence digital microscope (3D)**
- **Hitachi scanning electron microscope**
- **Wetting angle measurement device by Data Physics**
- **Tensile testing machine by Zwick**
- **TMI coefficient of friction tester**
- **Coating thickness gauge (profilometer model: Dektak 150)**

Our laboratory is fully equipped with all facilities and equipment needed for the optimum analysis of surfaces and has suitably qualified scientific personnel.

- This allows us to optimise the applications of our customers.
- Our lab has already enabled us to invent many new applications.
- Our development work has resulted in numerous technological and industrial property rights and patents.



electronic
diener
Plasma-Surface-Technology



Our Company Philosophy and Approach

Advanced solutions for success

Plasma technology is a relatively new field, but it is quickly spreading to almost all areas of industry. **Diener electronic has been around since the beginning and is one of the leading companies since 1993.** Our products are established across all areas of application for plasma technology, and we have pioneered new developments in many of these fields.

At our headquarters in Baden-Württemberg, we employ **more than 100 staff members.**

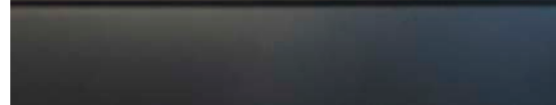
Extensive competence from first hand

We require a **high level of qualification** from our employees because our production is not standardised, but rather we tailor **all systems to the customer's needs.** Our large team of **engineers, technicians and scientists** are also available to help our customers with their concerns.

Outstanding in-house production depth

All main components, as well as the control software, are designed, produced and continuously optimised in-house. This allows for immediate reactions to quality problems. Special requests can be implemented quickly and easily.

With us, you stay ahead.
We stand for competence and innovation in an area of cutting-edge technology.



Rapid customer's and spare parts service

Customers can count on short response times in the event of maintenance or service work. The essential **spare parts** are in stock and can be shipped without delay.

Short delivery times

Standard systems can be built at any time within a few weeks. The essential components for all standard system types are always in stock.

Innovative power for new solutions

We operate extremely **fast and flexible.** New technological developments, changing market requirements and specific **customer requirements** do not represent a problem, but rather a welcome challenge for us. In this way, we are continuously improving our products, expanding their range of applications and opening up plasma surface technology to completely new fields of applications.



A Small Extract of Our References

The image features a world map with red highlights indicating global presence. The map is surrounded by logos of various companies and institutions, including:

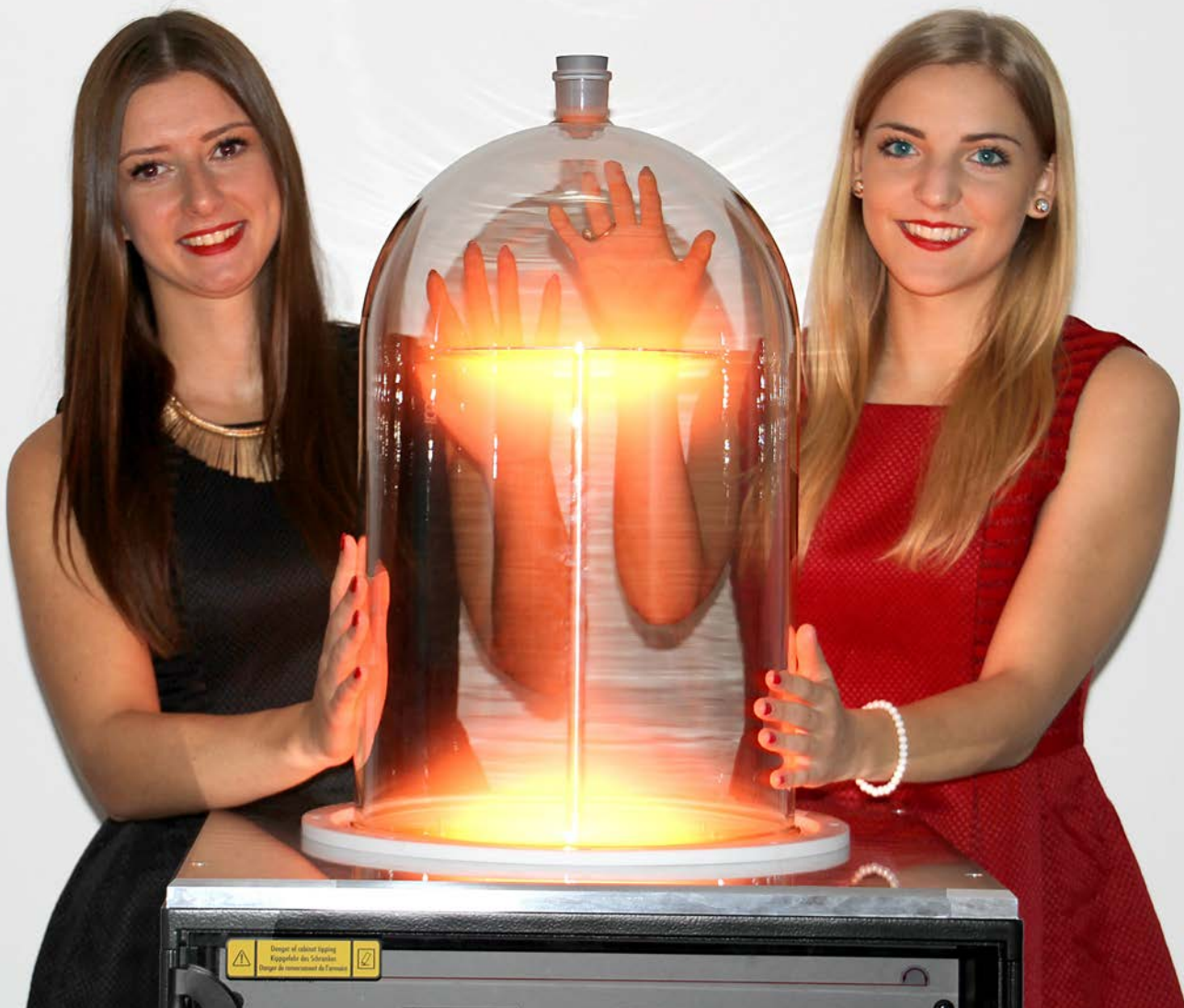
- Top Row:** ABIOMED, kiekert, CNRS, FAULHABER, TOYOTA, HOFMANN LEITERPLATTEN, LEONI, wohlfab, uvex, 7E MOTION AND MOBILITY, COLCOM, OLYMPUS, EPSON EXCEED YOUR VISION, DR. SCHNEIDER UNTERNEHMENSGRUPPE, SICK, ifm.
- Left Column:** PHILIPS, infineon, GRAMMER, TESAT SPACECOM, greiner bio-one, OLYMPUS OLYMPUS WINTER & IBE GMBH, SONY, Agilent Technologies, MAGNA, HIRSCH Das Armband seit 1765, PURDUE UNIVERSITY, BOSCH, SIEMENS, BALLUFF, EVONIK INDUSTRIES, sweden & martina, Continental, Valeo, SAINT-GOBAIN, SOURIAU, MIT, EPFL ÉCOLE POLYTECHNIQUE FÉDÉRALE DE LAUSANNE, JAGIELLONIAN UNIVERSITY IN KRAKÓW, Fraunhofer Gesellschaft, HUAWEI, KOLEKTOR, PLOCHER.
- Right Column:** Radiall, TRUMPF, DAIMLER, BAYER, Linde, FESTO HEIDELBERG, Honeywell, EPCOS, P&G Procter & Gamble, BRAUN, Kimberly-Clark PROFESSIONAL.

Among our customers are well-known companies in the automotive, electronics, semiconductor and plastics industries as well as institutes and research organisations.

Diener electronic plasma systems: in demand worldwide

You Can Benefit Too

Please feel free to contact us. Tell us about your surface problems, and we will be happy to inform you about all the possible solutions.



From our staff:
Nicole, Industrial Sales

Katharina, Process Development

All pictures were taken by the company Diener electronic GmbH + Co. KG and show our own employees. All pictures are the property of Diener electronic GmbH + Co. KG. Use, reproduction and distribution of our photographic material requires our prior written consent. (February 2016)

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