

Plasma Surface Technology



Femto



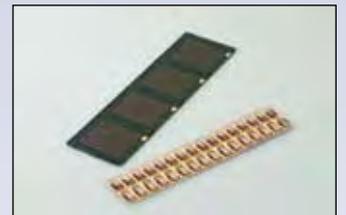
Plasmabeam



Tetra-30-LF-PC



Precision engineering



Semiconductor technology



Electrical engineering



Elastomer technology



Plastics technology



Medical technology



Where are the applications for plasma technology?
When it comes to modified **surfaces**, we have the solution!

Surfaces

Plasma technology – so many possibilities

Plasma is used in areas where **joining** of materials, or precise modification of their **surfaces**, is important. This forward-looking technology enables the most varied **surfaces** to be **modified**. As a result it offers diverse possible applications like, for example

- **Precision cleaning** of small and micro components
- **Activation** of plastic components before gluing, painting, etc.
- **Etching** and, in some cases, removal of different materials such as PTFE, photoresist paint finish, silicon etc.
- **Coating** of components with PTFE-like layers, barrier layers, hydrophobic and hydrophilic layers, friction reducing coatings, etc.

Plasma technology is now firmly established in almost all industrial sectors. New applications are emerging all the time.

Plasma technology – winning advantages

Compared with other processes like flame treatment or wet chemical treatment, for example, plasma technology demonstrates significant advantages:

- Many **surface properties** can only be achieved with this process
- Universally applicable process: can be used **online** and fully automated
- Extremely environmentally friendly process
- Powders, small parts, plate material, fleeces, textiles, hoses, hollow parts, printed circuit boards, etc. can all be handled, virtually **irrespective of their geometry**
- Components are **not mechanically modified**
- **Very little heating** of components
- Very **low running costs**
- **High process reliability and occupational safety**
- Highly **efficient** process



Special system Tetra-5600-LF-PC-D

vacuum switch

K1

door switch

K2

generator

K3



How does a **plasma system** work and what types of system are there?

There are two different types – low pressure and atmospheric pressure plasma systems

Plasma system

Low pressure plasma technology

In low pressure plasma technology, gas in a vacuum is excited by a supply of energy. Energy-rich **ions** and **electrons** are created along with other reactive particles that form the plasma. So surfaces can be modified very effectively. There are three different plasma effects:

- **Micro sandblasting:** the surface is sputtered by the ion bombardment
- **Chemical reaction:** the ionised gas chemically reacts with the surface
- **UV radiation:** the UV radiation breaks down long-chain complex carbon compounds.

Varying the process parameters such as pressure, power, process time, gas flow and gas composition changes the operating characteristics of the plasma. So a number of effects can be achieved in a single process step.

Atmospheric plasma technology

In atmospheric plasma technology, gas at **atmospheric pressure** is excited by means of a **high voltage** in such a way that a plasma ignites. Compressed air then forces the plasma out of the nozzle. There are two different plasma effects:

- **Activation and precision cleaning** is carried out by the reactive particles contained in the plasma beam
- In addition, loosely adhering particles are removed from the surface by the compressed air accelerated **active gas beam**.

Varying the **process parameters** such as treatment time and distance from the substrate surface allows the results of the treatment to be influenced in different ways.

Diener plasma surface technology – winning systems

Our comprehensive programme includes **standard and special systems** for all plasma applications. We offer **tailored solutions** that we design and produce individually if required. And we give a comprehensive **product warranty**, of course.

Key features of our systems:

- **Customised adaptation**

When we design our products, we consistently adapt to customer requirements and modify our systems accordingly.

- **High availability, long service life**

Downtimes are reduced to a minimum by selecting high grade components. The service life is practically unlimited. Our above average level of vertical integration means that we can respond to breakdowns promptly.

- **Simple operation**

We have continuously improved our controllers so that our plasma systems are easy to operate.

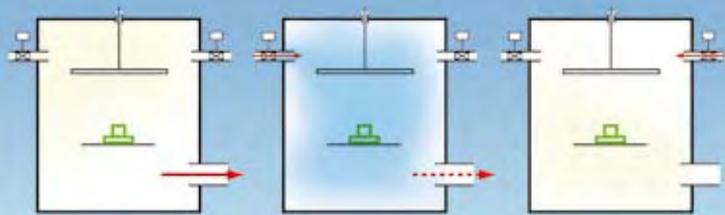
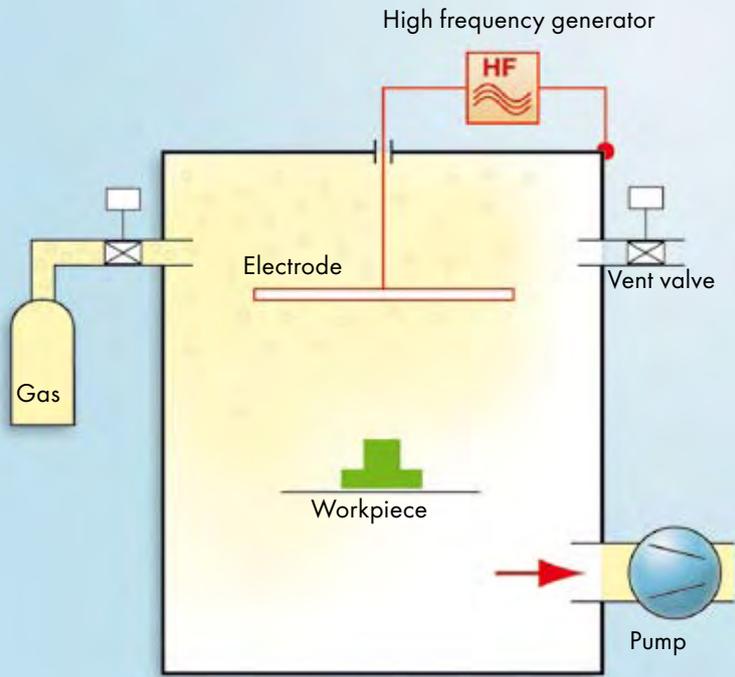
- **Semi automatic, fully automatic, or PC control**

Customers can choose from **semi-automatic, fully automatic, or convenient PC control**.

- **Universally applicable**

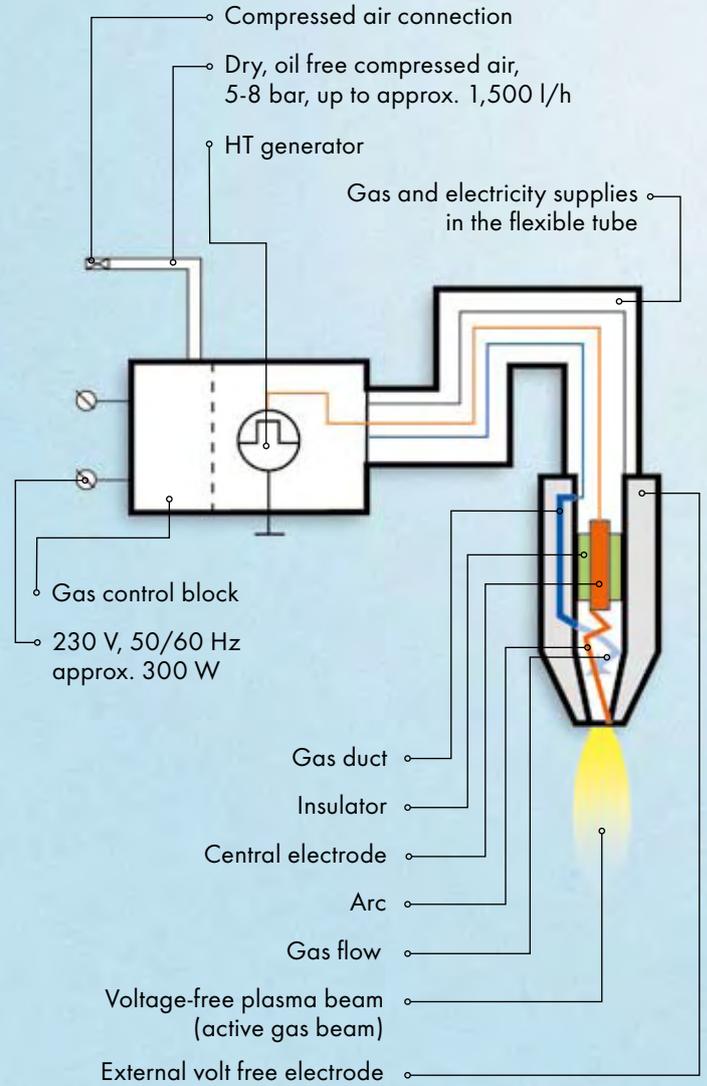
We have the right system concept for every application. Whether you want to operate on a laboratory scale or in full-scale 3-shift production, chamber volumes from **2l to 12,600l** have already been successfully implemented.

Low pressure plasma system



1. Evacuation of the chamber 2. Admission of the process gas and ignition of the plasma 3. Ventilation and removal of the workpieces

Atmospheric pressure plasma system

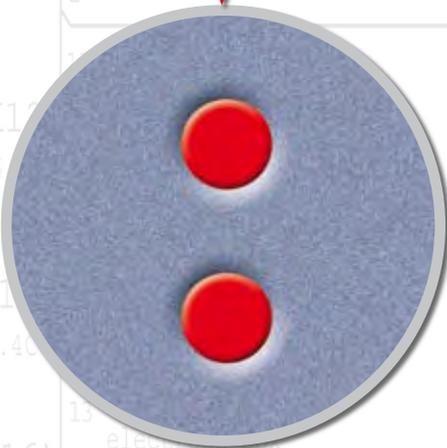


Low pressure plasma technology or atmospheric plasma technology?

Plasma flame

Low pressure plasma system	Atmospheric pressure plasma system
Especially suitable for treatment of 2D and 3D components	Especially suitable for treatment of 2D components
Bulk materials can be treated	Can be integrated in existing automated systems
Batch processes	Continuous processes possible





With us you'll stay out in front.
Our name stands for **competence**
and **innovation** in a forward-
looking technology

Competence and Innovation



Success through advanced solutions

Diener electronic is a young, **high-tech** company in the growth market of **plasma surface technology**. Operating at a number of locations in Baden-Württemberg (Germany), we design and produce innovative solutions for economic, precise and environmentally-friendly plasma treatment of surfaces – and with great success. Since the company was set up in 1993, we have grown continuously and are now one of the world's leading manufacturers of plasma systems.

Total competence from a single source

Our customers benefit from the experience and **know-how** of a dedicated and committed staff and a state-of-the-art production facility.

Above-average level of vertical integration

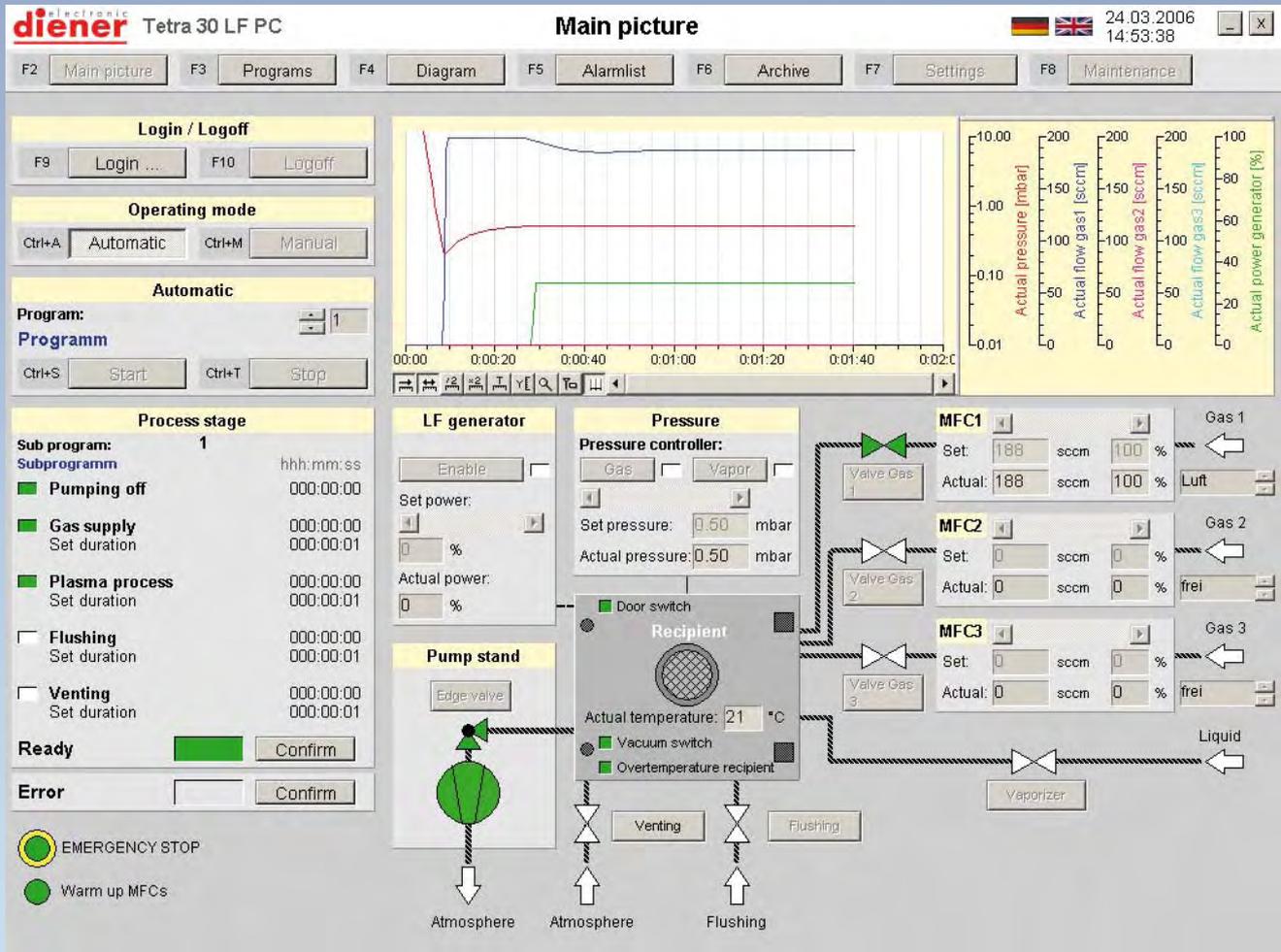
We design, produce and constantly optimise all main components and the control software. As a result, we can respond to quality defects immediately. Special requests can be put into practice quickly and simply.

Fast service and spare parts service

When it comes to maintenance and service, our customers can count on short response times. The right spare parts are in stock, ready for immediate despatch.

Short lead times

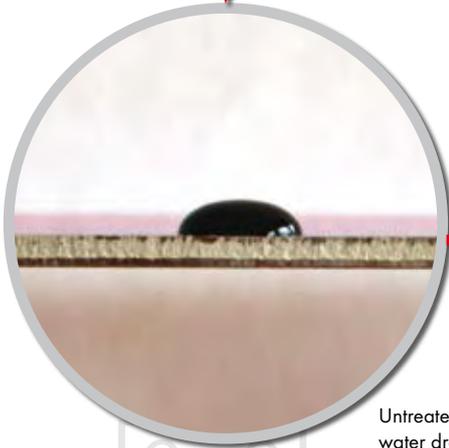
Standard systems can always be built within a few weeks. The important components for all standard types of system are always in stock.



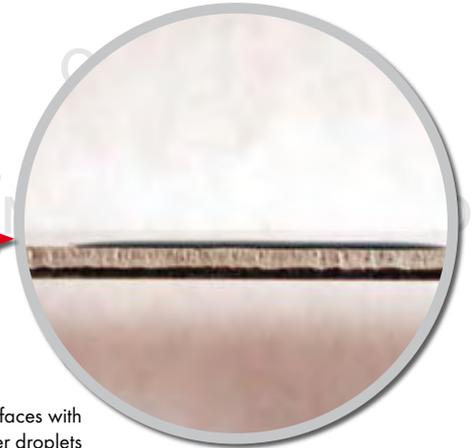
Innovation power to solve new problems

We operate **quickly and flexibly**. We see new technical developments, changing market demands and special **customer requests** as a welcome challenge, rather than a problem. That's how we continuously improve our products, broaden their spectrum of use and open up completely new fields of application.

In **cleaning**
Practically every material can be
precision cleaned with plasma

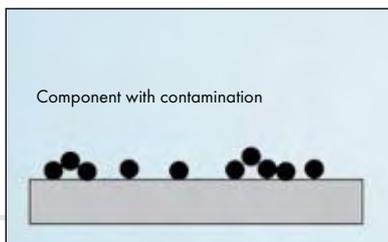


Untreated surfaces with
water droplets

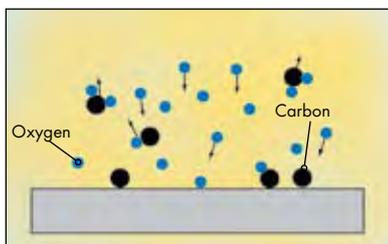


Plasma-treated surfaces with
water droplets

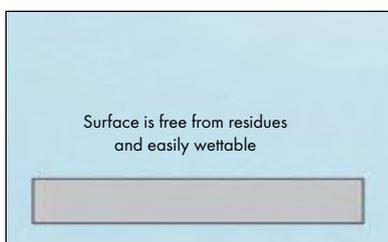
Cleaning



Before plasma treatment



Plasma treatment



After plasma treatment

The surface of the component is physically cleaned by **ion bombardment** and – depending on the type of gas – also cleaned by **chemical reactions**. The contamination is converted to the gas phase and sucked away.

Applications

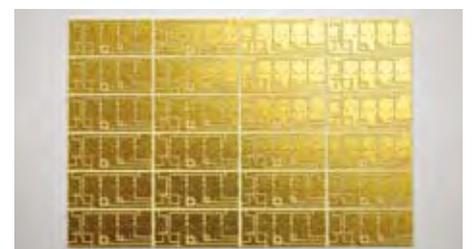
- Removal of grease, oil, oxides, fibres
- Removal of silicones (LABS-free)
- Pretreatment before bonding, soldering or gluing
- Pretreatment of metal parts before painting etc.

Components

- Electronic devices
- Rubber-metal joints
- Switches
- Sensors
- Implants
- Stents
- Micro-components
- „O‘ rings
- Screws
- Laser components
- Silicon-contaminated seals
- etc.

Users

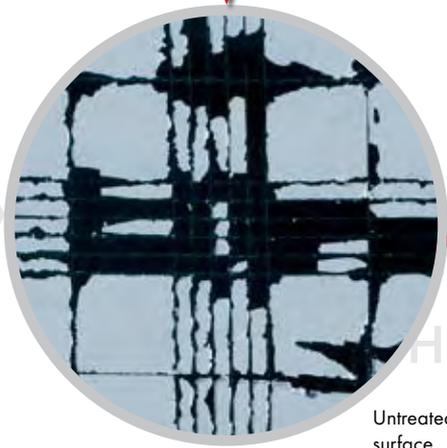
- Automotive technology
- Electronics industry
- Filter manufacturers
- Research institutes
- Rubber processors
- Semiconductor manufacturers
- Industrial painters
- Paint manufacturers
- Medical technology
- Sensor technology
- etc.



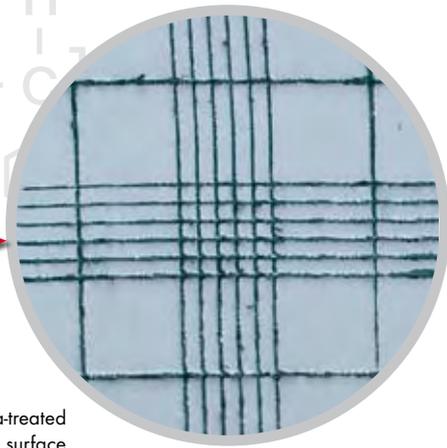
9 Where is plasma technology used? – Anywhere where s

In **activation**

Practically every material can be activated with plasma



Untreated surface



Plasma-treated surface

Activation

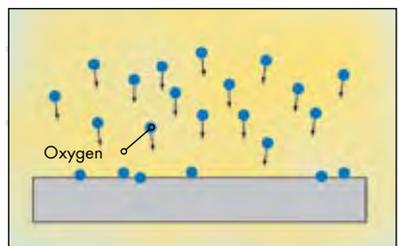


Component before plasma treatment

The surfaces of the component are activated with oxygen or air, for example. **Radical sites** are created to which the paint or glue systems adhere very well.

Applications

- Pretreatment before gluing
- Pretreatment before painting
- Treatment before printing



Plasma treatment

Components

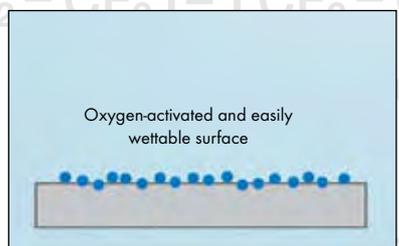
- Sensors
- Switches
- Catheters
- Headlight reflectors
- etc.



Users

- Aluminium coaters
- Automotive technology
- Seal/gasket manufacturers
- Electronics industry
- Research institutes
- Rubber manufacturers
- Industrial painters
- Adhesives manufacturers

- Paint manufacturers
- Medical technology
- Sensor technology
- Textile manufacturers
- Watch and clock makers
- etc.



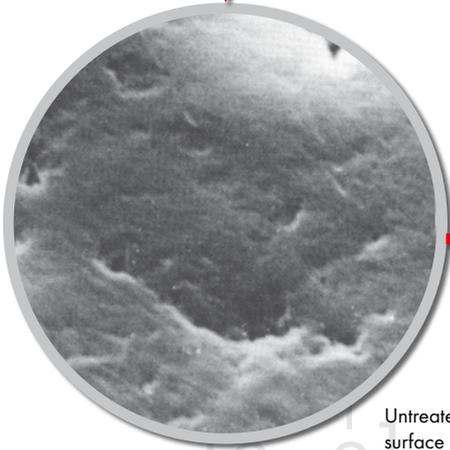
After plasma treatment

possible applications

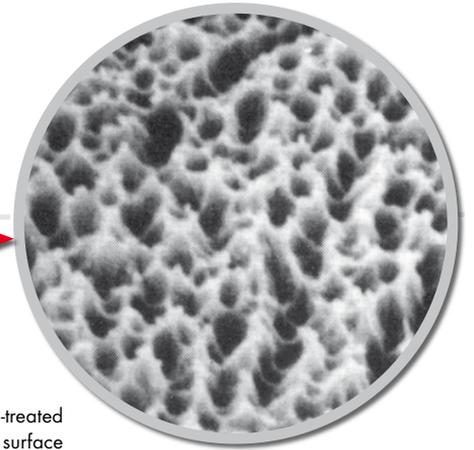
surfaces have to be modified precisely and efficiently.

In etching

Plastics, semiconductors, glass

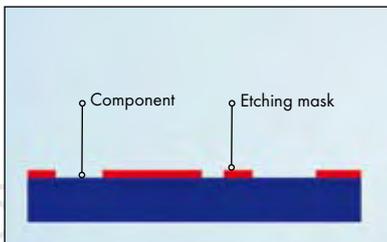


Untreated surface

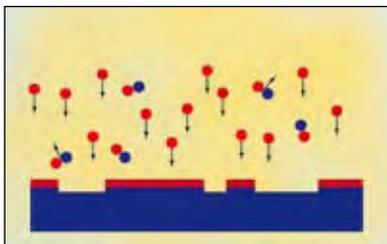


Plasma-treated surface

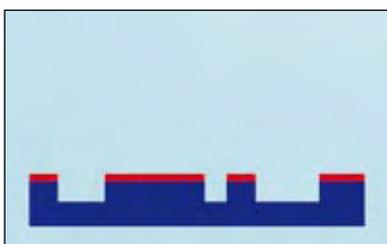
Etching



Component with etching mask before plasma treatment



Plasma treatment



After plasma treatment

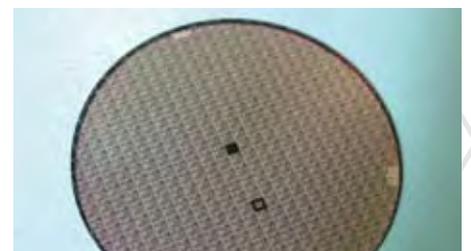
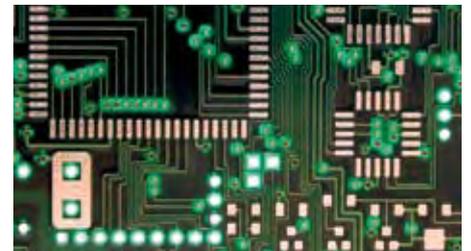
The surface of the component is **etched** with a reactive **process gas**. Material is precisely sputtered off, converted to the **gas phase** and sucked away. The surface is enlarged and is very easily wettable. Etching is used before printing, gluing and painting, as well as for "roughening up" the material.

Applications

- Structuring silicon
- Etching PTFE
- For good paint and glue adhesion with high temperature resistant plastics, such as PTFE, PFA and FEP, for example
- Photoresist ashing

Components

- Component openers (semiconductor)
- Brackets (dental technology)
- Pacemakers
- Sensors



Users

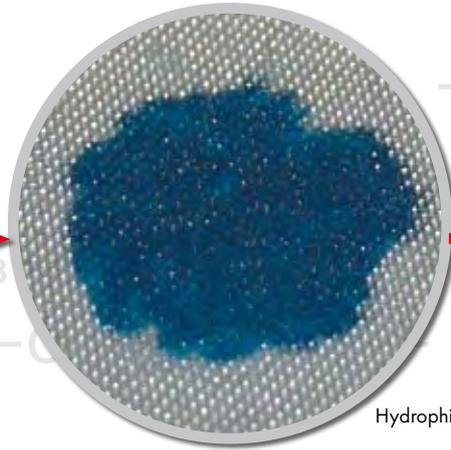
- Automotive technology
- Seal/gasket technology
- Electronics industry
- Research institutes
- Semiconductor technology
- Medical technology
- Micromechanical manufacturers
- Sensor technology
- etc.

In **coating**

All technical materials, metals, glass, ceramics



Untreated surface

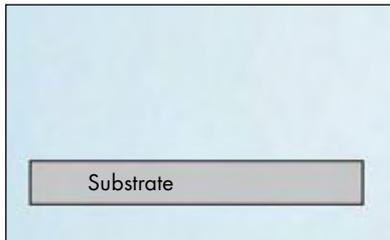


Hydrophilic

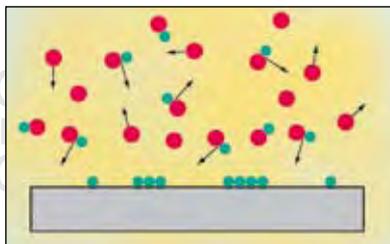


Hydrophobic

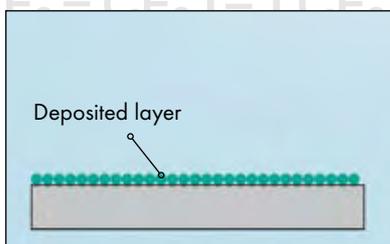
Coating



Before Plasma treatment



Plasma treatment



After plasma treatment

Plasma polymerization

A monomer is introduced to the plasma chamber. The gas is atomised by the plasma and deposited on the surface of the component.

Applications

- Deposition of hydrophobic layers
- Deposition of hydrophilic layers
- Deposition of protective or insulating layers
- Use as a diffusion barrier, for example

Components

- Precision gears
- Dish-washers
- Medical equipment
- Headlight reflectors
- Video heads
- etc.

Users

- Biochip manufacturers
- Precision engineers
- Dish-washer manufacturers
- Medical technology
- Sensor manufacturers



- Textile manufacturers
- Watch and clock makers
- etc.



Can we offer you something more?

A **service package** that meets all expectations!

Service package

You are the centre of attention at Diener

Our strengths lie in the competent **advice** and individual **support** we give our customers. We always endeavour to find the optimal solution for your special requirements, because we don't see ourselves as a manufacturer and supplier of plasma systems, but as primarily a service provider and **problem-solver** in the field of plasma surface treatment.

You can play it safe with us - test it first, then decide

We'll tell you exactly which system is best suited for your application or particular problem. To be absolutely certain, you can send your **samples** to us for **free treatment**, or we'll provide you with a **test system**. On top of this we offer surface analyses and preparation of system concepts. When you've decided on a system, we provide on-site support during the commissioning and process development stages.

We're permanently on standby - you call, we'll come

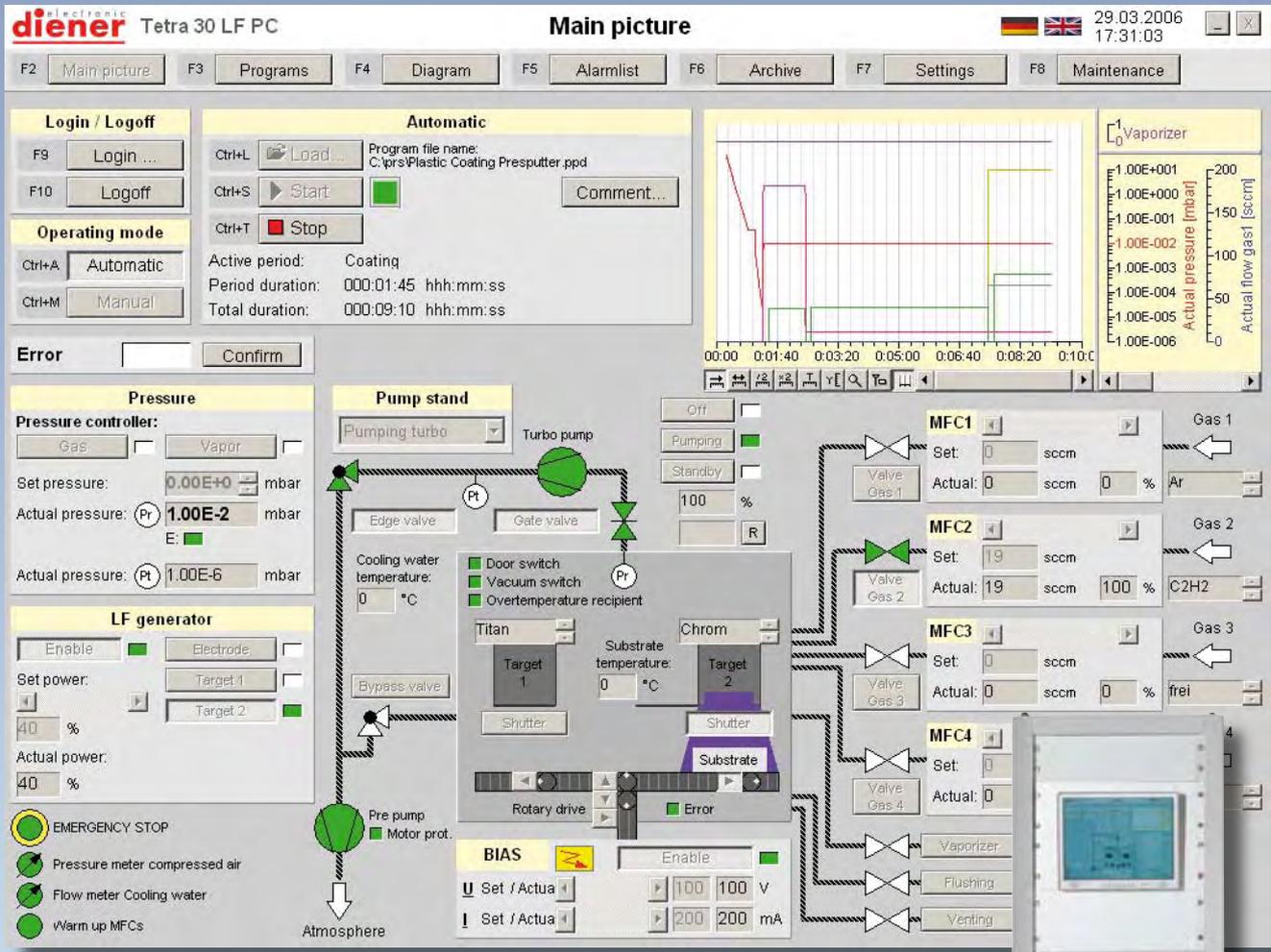
Both before and after the purchase of a system - we are always there for you. If you have a breakdown, the important spare parts are in stock here. We offer a fast, reliable customer service, standing by with help and advice at any time, to ensure that you are back in full production as quickly as possible.

Buy, rent, subcontract treatment - the choice is yours

If it's uneconomic to buy a plasma system, you can also rent one from us. And if you don't want to take on the surface treatment of your components yourself, we can offer you our in-house subcontract treatment. Various plasma systems are available for this, together with qualified, experienced staff, who will ensure an optimal surface quality for your parts and components.

You're in the best possible hands with Diener electronic

Benefit from our **long experience** in the application, design and construction of plasma systems. Our specialists will help you optimise your working processes. You can also take advantage of our know-how and unique product and service package in the field of plasma surface technology.



Amorphous diamond-like carbon films (a-C:H, DLC = „diamond-like carbon“)

What are amorphous diamond-like carbon films?

Amorphous diamond-like carbon films consist of a highly cross-linked hydrocarbon matrix and are deposited by means of PVD (Physical Vapour Deposition) or PACVD (Plasma Activated Chemical Vapour Deposition) processes.

Main field of application

Coating of all kinds of machine parts and tools

Purpose:

- Extending service life and tool life
- Lubricant-free applications

Typical features:

- Film thickness: 0.5 – 5 µm, high hardness
- Low surface roughness
- Extremely friction and wear-reducing
- Highly resilient and impact resistant
- Chemically resistant
- Biocompatible



Diener plasma systems – in demand **worldwide**

worldwide

Our customers include, among others, prestigious companies from the fields of **automotive, semiconductor and plastics technology, electrical engineering**, as well as **institutes and research facilities**.





 **Fraunhofer**
Gesellschaft

 **BOSCH**

3M

FESTO

Linde

SIEMENS VDO

Honeywell

CHERRY 

BALLUFF



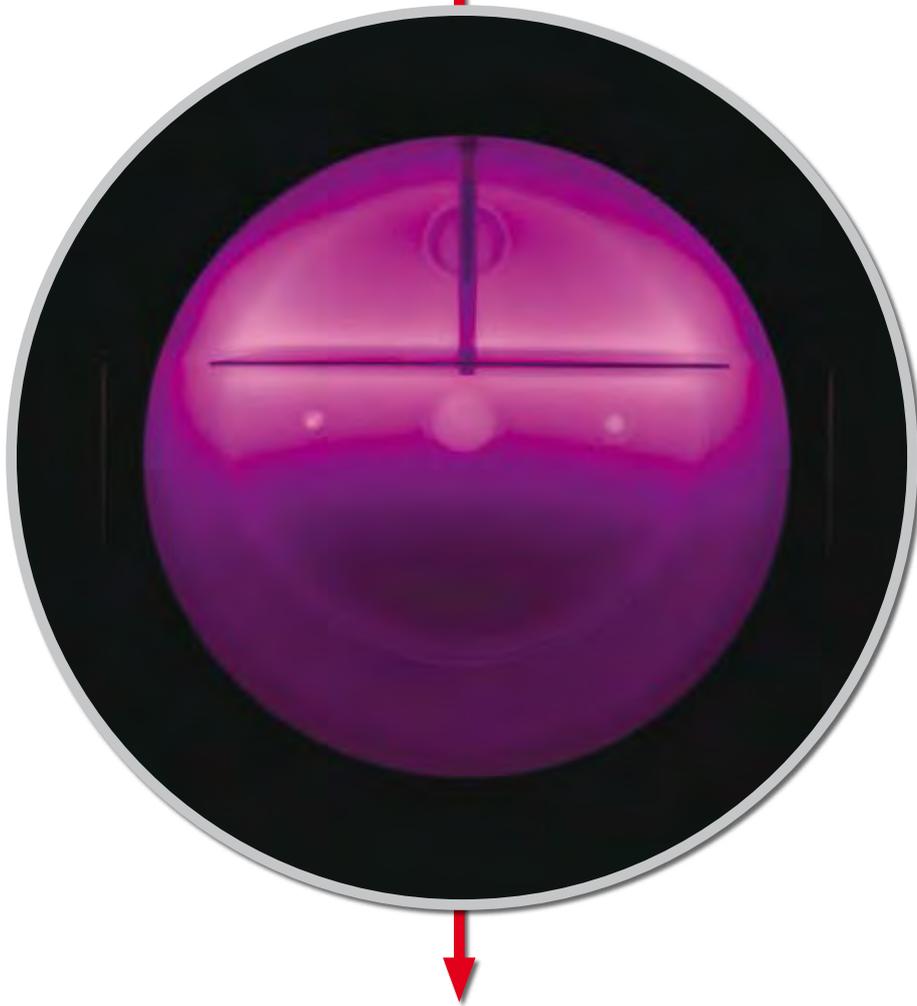
OLYMPUS
OLYMPUS WINTER & SIE GMBH

 **Agilent Technologies**

diener^{electronic}
Plasma-Surface-Technology

You can **benefit** too

Just get in **contact** with us and describe your **surface problem**. We'll be happy to advise you on **possible solutions**.



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