

# CYRANNUS®

## Company Profile



R&D100 Award 2003



Young Female Entrepreneur  
Award 2000

„Aus den praktischen  
Erfahrungen mit den Hidden  
Champions lernte ich mehr über  
Management als in zwei  
Jahrzehnten wissenschaftlicher  
Forschung“

Prof. Simon (founder of Simon,  
Kucher & Partners)

**CYRANNUS®**  
cylindrical  
resonator with  
annular slots

int. patents approved or  
pending, e.g.

EP 97906173

EP 98928283

EP 0872164

US 6204603 B1

US 6198224

US 6543380

JP 531466

JP 524812

World leader in higher  
pressure microwave  
plasma technology

**CYRANNUS® technology**

**Plasma easy to apply!**

## Our mission

iplas is the world leader in microwave plasma technology at higher pressure. As a result, iplas provides unique products and services that help our customers to improve productivity and to run more efficient applications. Our principle is to offer solutions that are easy to use and reliable in operation. iplas strives for close relations with business partners in order to promote plasma technology and to create joint value.

### History and founders



iplas gmbh was founded in 1997 near Cologne, Germany by Dr.-Ing. Dipl. Phys. Hildegard Sung-Spitzl, and Dr. rer. nat. Ralf Spitzl. Both have profound knowledge in fundamental and applied physical research, in plasma technology and in high tech-management as well.

Dr. Sung-Spitzl has been working in thin film technology since 1989. In addition to her experiences in applied engineering, Dr. Sung-Spitzl contributed broad consulting know-how to the successful development of iplas.

Dr. Spitzl has been researching plasma physics since 1987. Furthermore he compiled broad knowledge in the area of public R&D funding. In 1996 Dr. Spitzl invented the *CYRANNUS*<sup>®</sup> plasma source. Realizing its commercial potential the *CYRANNUS*<sup>®</sup>-technology was first patented in 1998.

Up to the present the company is 100% privately owned by the two founders.

# Milestones in company's history

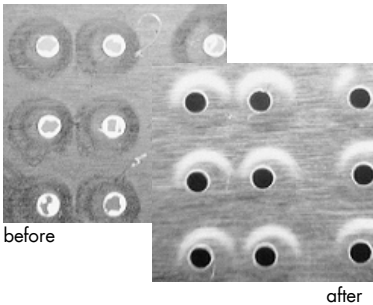
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- 1999: iplas introduces the linearly shaped *CYRANNUS*<sup>®</sup> II plasma source.
- 2000: In South Korea Woosin Cryo Vac contracted as the first international distributor. Today, iplas cooperates with sales partners in 10 countries.
- 2000: Dr. Sung-Spitzl is ranked Germany's No. 1 in the "Idee Förderpreis", awarding her achievements as young female entrepreneur.
- The first European and US- patents were granted in 2000, and 2001 respectively. Today, iplas holds more than 20 international patents.
- 2002: iplas initiates the *CYRANNUS*<sup>®</sup>-Symposium as a platform for users of *CYRANNUS*<sup>®</sup> technology and medium pressure plasma.
- 2002: The company moves to its new location. On a total area of 1,500 m<sup>2</sup> one now has the possibility research, build and demonstrate the various applications of *CYRANNUS*<sup>®</sup> technology in a spacious environment.
- 2003: iplas presents the 16-inch *CYRANNUS*<sup>®</sup> I as the world's largest commercial microwave plasma source running at atmospheric pressure.
- 2003: iplas and Argonne National Laboratory gain a "R&D 100 Award" for exceptional performance of the *CYRANNUS*<sup>®</sup> technology.

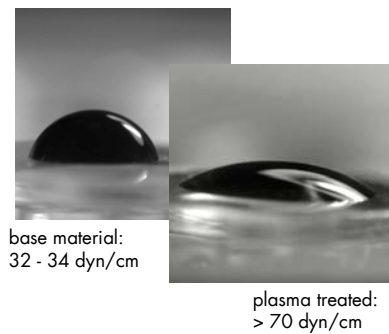
# Applications

Plasma is a high energy containing gas which can be used for treatment of various surfaces or for reactions in the gas phase. The variety of applications cover a large spectrum of branches. Therefore plasma technology is a key technology.

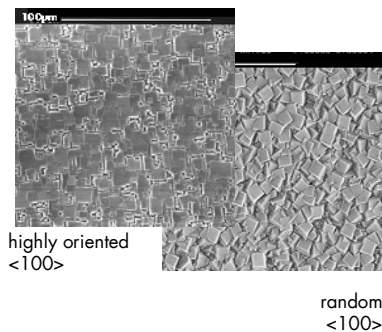
## desmearing



## polymer activation



## diamond deposition



## etching / ashing

removal of photo resist, stripping of coatings

⇒ >1-6 µm/min, 10-15sec for desmearing

removal of oxides from metal

⇒ lead frame cleaning within few seconds

## cleaning

ultra cleaning, degreasing

⇒ fast on-line cleaning

## activation

improved wetting of varnish, increased adhesion

⇒ 3D plastics activation, 1-10 sec, >70 dyn/cm

## functionalisation

hydrophobic surface

⇒ < 10 sec

surface conditioning for thermal bonding of metal and PE without adhesives

## deposition

various coatings (scratch resistance, optics)

⇒ growth rate of several µm/min(SiOx) or  
10 µm/h(diamond)

diamond structures

⇒ windows, free standing structures, MEM

## complete cracking of molecules

destruction of molecules, oxidation

⇒ abatement, exhaust cleaning, waste destruction

# Medium pressure for easier processes

Running a plasma process in medium to ambient pressure allows more efficient processes.

## Parameters

### Influence on process

Pressure	Medium to higher pressure can tolerate vacuum leakage or ingress of water (residual pressure of water) in the equipment without negative influence on the production process.
Density	A high amount of active species enables fast plasma processes. The quantity of neutral radicals can be up to 1000 times higher than ionised radicals.
Gas flow	A process pressure of some 10 to 100 mbar shifts gas phase processes to flow conditions. Instead of diffusion now the area of plasma treatment can be designed more actively by flow dynamics.

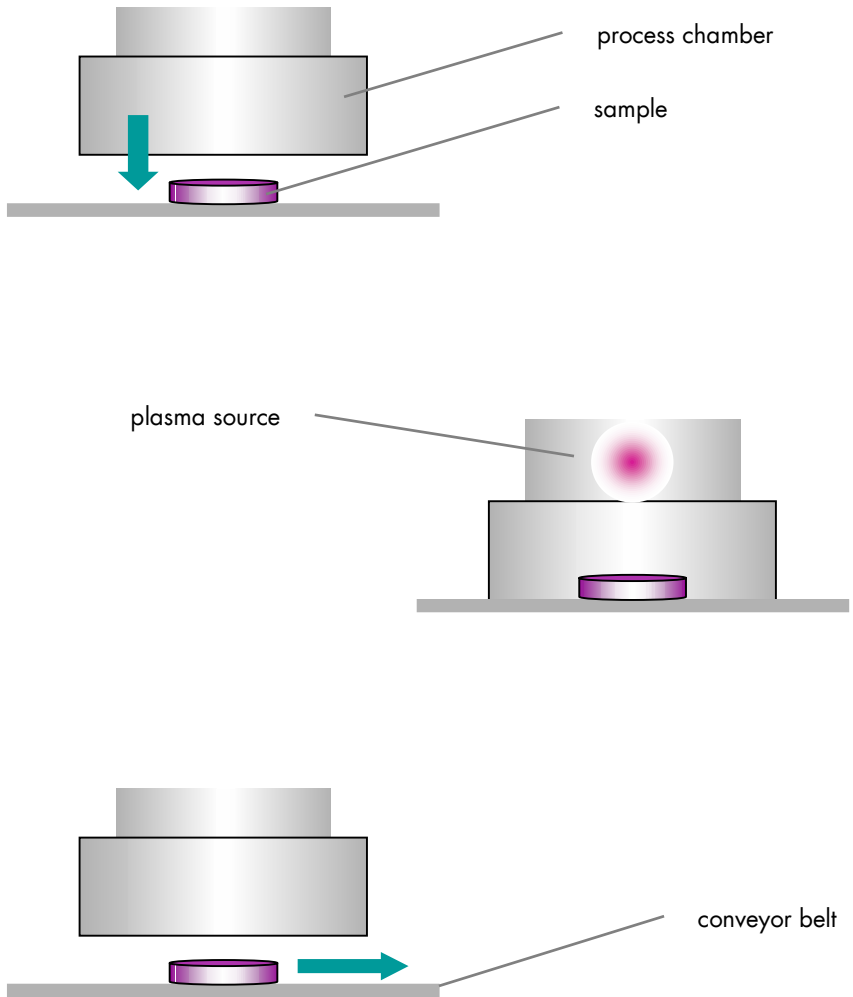
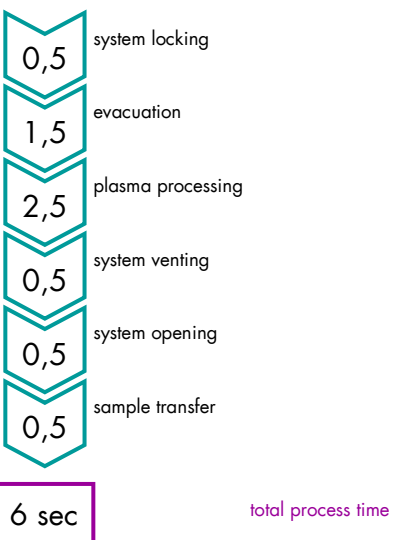
## Examples

Plasma process	Conventional high vacuum plasma	CYRANNUS® medium pressure plasma
Activation of textiles or plastic parts	2-5 min treatment	2-10 sec
Deposition of polymers or glass on plastics	1 $\mu\text{m}/\text{min}$	2-5 $\mu\text{m}/\text{min}$
Diamond deposition	$\ll 1 \mu\text{m}/\text{h}$	1-10 $\mu\text{m}/\text{h}$

# In-line and on-line processes

CYRANNUS® enables plasma processes with in-line or on-line operations as well. A simplified set-up due to medium pressure operation allows very short treatment time and fast material handling.

## Operation sequence



## Process scalability

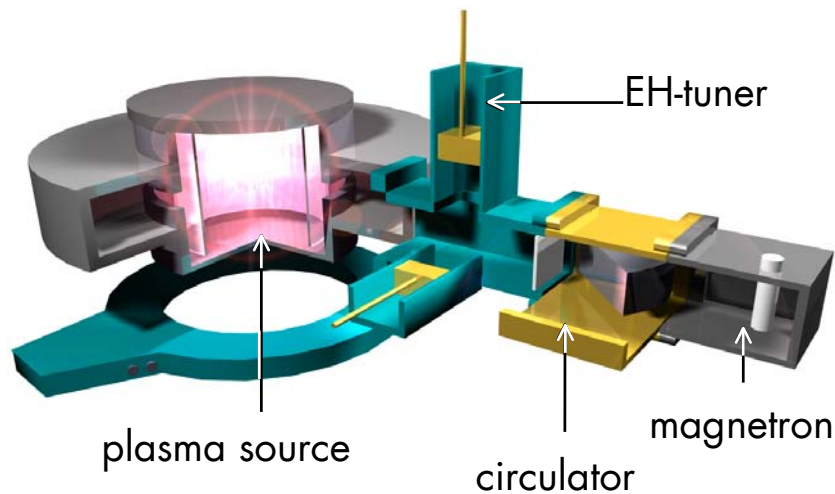
- Arrays of linearly shape plasma sources for larger parts
- Faster feeding mechanisms by duplicated locking systems

## Products and services

iplas offers a complete spectrum of plasma technology on different levels of automation to meet the users' requirements at it's best. The spectrum covers all equipment from plain plasma sources to automated plasma systems. If necessary such systems can be supplied with an individually optimized or developed production process.

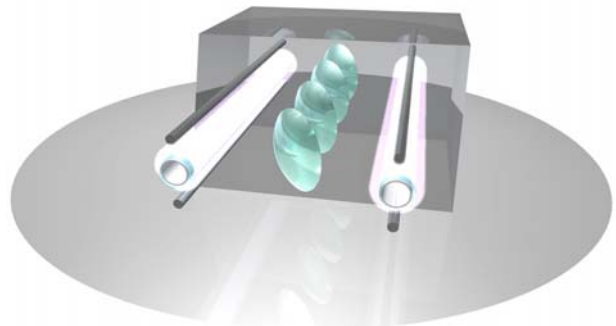
### **CYRANNUS® I plasma source**

bases on an innovative concept of coupled resonators. Long experience in various applications of medium to atmospheric pressure plasma processes enable iplas to supply optimized equipment. Surface treatment inside the plasma source or in the down stream plasma can be run with high efficiency as well as gas phase processes.



### **CYRANNUS® II plasma source**

The patented coupling concept is also the basis for the linear plasma sources. The plasma is fed with energy through several antennas and therefore stable at lower and medium pressure. *CYRANNUS® II* operates excellent with oxygen and air. The plasma source can be adapted to the dimensions of the production system.



# CYRANNUS® plasma systems

can be used as stand-alone integrated into a process chain where it covers a single or several process steps.

It is our intention to supply plasma technology with highest advantage for users. This includes that our customers do not have to care about the plasma.

## Reliability and speed

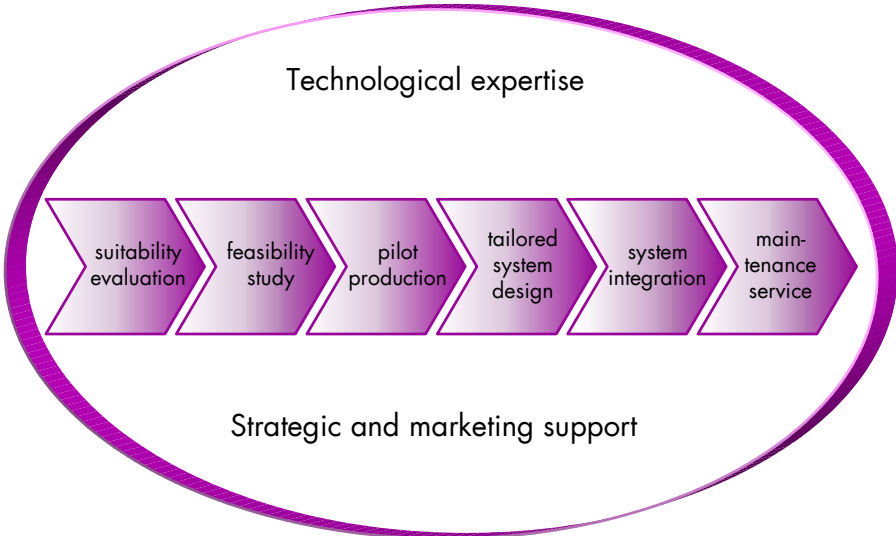
are two of the greatest advantages which have been gained from CYRANNUS®/I technology. These are the key factors for successful plasma technology in production.

Individual modification of the system are feasible within very short time due to modular design.



## iplas services

iplas runs own research and development facilities at Troisdorf which are available for feasibility investigations and contract research.



# References

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## Customers in industry (extract)

- AISA (offers production systems), Vourvry – Switzerland
- Ulvac, Susono – Japan
- SIG combibloc, Linnich – Germany
- Shell Global Solutions, Amsterdam – Netherlands
- Centrotherm, Dresden – Germany
- PETpower, Etten-Leur – Netherlands
- Elopak, Zürich – Switzerland
- Korean Gas Corporation, Seoul – Korea

Plus several companies from optics, environment technologies, packaging and semiconductor with whom we agreed not to publish their names

## Customers research / development (extract)

- Argonne National Lab (ANL), Chicago – USA
- Institut für Niedertemperatur Plasmaphysik (INP), Greifswald – Germany
- Eidgenössischen Materialprüfungsanstalt (EMPA), St. Gallen – Switzerland
- Institut für Textilchemie (ITC), Denkendorf – Germany
- Korean Institute of Science and Technology (KIST), Korea
- Universität Linz – Austria
- CNRS, Orlean – France
- Universität von Zheng Zou, VR China
- Inasmet, San Sebastian – Spain
- University of Osaka, Japan

# Contact iplas

It would give us a great pleasure to answer any further questions about the innovative plasma technology and its application. A meeting can be arranged on short notice. Visitors are welcome at our R & D laboratory for a personal demonstration of the *CYRANNUS*<sup>®</sup> plasma technology with various applications. Please do not hesitate and contact us or our distributors:

## Headquarter



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