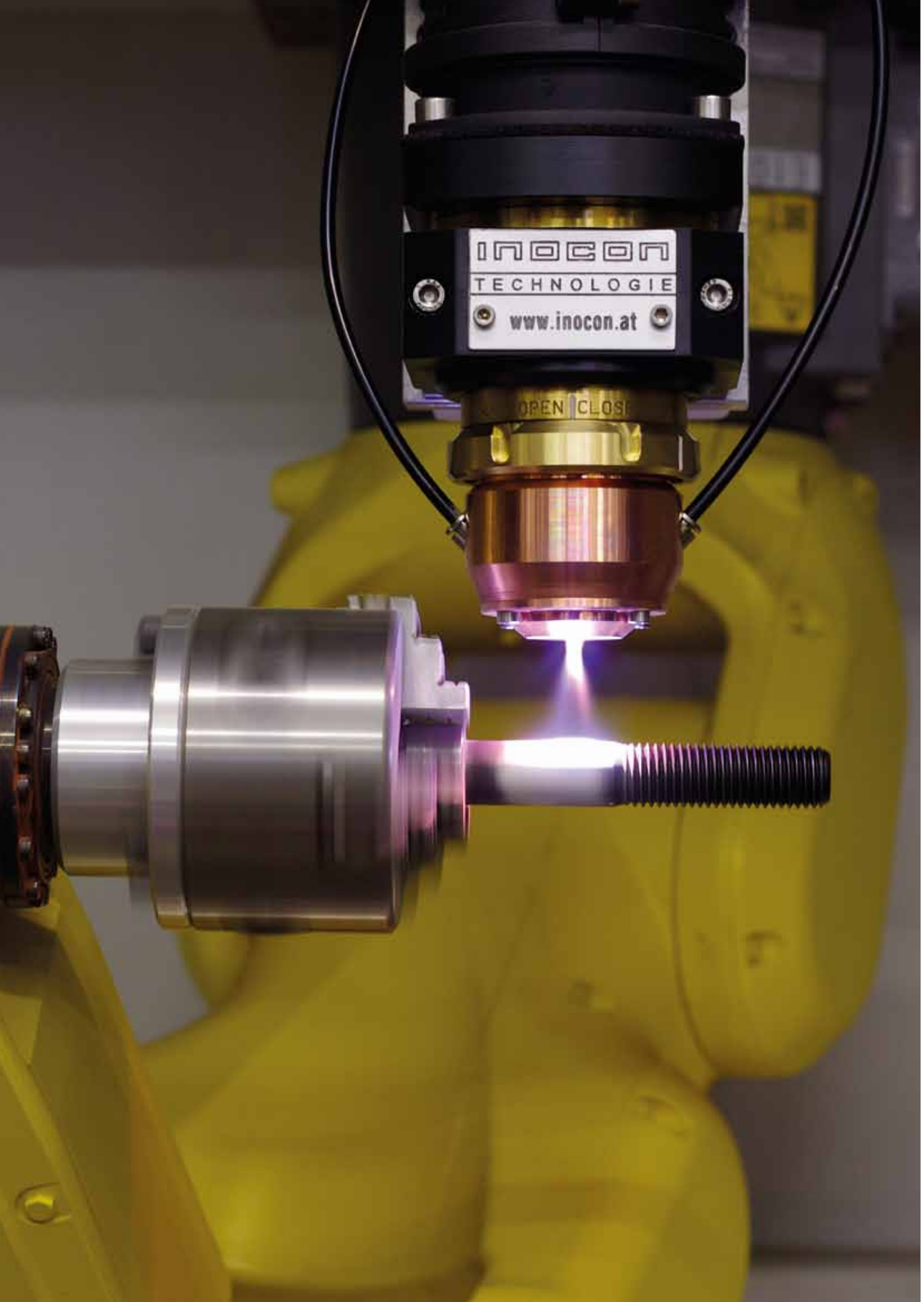
INOCON

InoCoat Atmospheric Plasma Spraying

Redefined Surfaces



INOCON
TECHNOLOGIE

INOCON Technologie GmbH looks back on 20 years of experience in the field of plasma technology. We have developed numerous plasma applications for brazing and welding and have successfully implemented them based on our experience with plasma hardening. Several projects were undertaken which led to the development of the patented Plasmatron® torch. This product is used for high-end welding operations in several areas. With this process, INOCON serves several renowned international companies, particularly in the automotive industry. These include, for example: Audi, Volkswagen, Ford, PSA, Renault and many more. Several customers in other industrial sectors also make use of this process.

Since 2012 the company has been developing several applications in the area of atmospheric plasma coating. The coatings are micro and nano layers, which are applied on sensitive surfaces such as paper, plastics, glass, ceramics and wood as conductor paths or adhesive and anti-adhesive layers.

In the area of mechanical engineering, Inocon undertakes manufacturing for almost all sectors of industry, from small solutions to large production lines, making an economically viable use of the available energy resources and series components. The reference customers of the company include: Daimler AG, DANA Group, Miele, Montblanc, Voith and many more. With a more than 90 percent export ratio, Inocon is in a strong position internationally.

"The potentials resulting from nanotechnology forces the industrial sector to face the task to quickly implement results from research and development into practical applications to maintain and expand on the connectivity within the international competition."

Luther, Malanowski 2004

VISIONARY PROCESS

The Atmospheric Plasma Spraying process is technologically far superior to other procedures. The core of the process is **the targeted feeding of powder and precursor** into the plasma jet, which is up to several 1,000° Celsius hot. Two key criteria are responsible for the coating quality: Firstly, the **low heat input** into the substrate through the focused plasma jet. Secondly, the coating material as a special powder or as precursor vapour.

This makes it possible to achieve at atmospheric pressure, – i.e. without vacuum – extremely dense and compact coatings without solvent and at unprecedented speed. The plasma coatings themselves are still extremely adhesive even with a thickness of a few µm or a few nm.

UNIQUE TECHNICAL SPECIFICATIONS

COATING PROCESS IN AN ATMOSPHERIC ENVIRONMENT

No vacuum cell is required for smooth operation. The economical use and easy integration into the automatic operation is thus guaranteed. Depending on application, the coating chamber can be flooded, e.g. with nitrogen.

OUTSTANDING AUTOMATION

The inline capability – and the resulting scalability – is provided by the atmospheric process.

ENVIRONMENTALLY-FRIENDLY PROCESS

In comparison to other wet-chemical coating processes, the plasma coating process has no negative impact on the environment.

LOW THERMAL INFLUENCES ON THE SUBSTRATE

Powder and precursor coating on the most sensitive substrates such as paper, wood, textiles or polymer is unproblematic.

MICRO- AND NANO-LAYERS IN A MACHINE

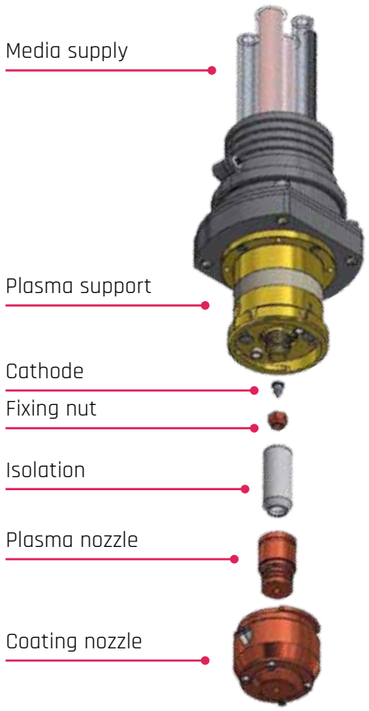
The plasma coating process can handle a range of powder/precursor types either simultaneously or subsequently. This results in an innovative layer with completely new properties.

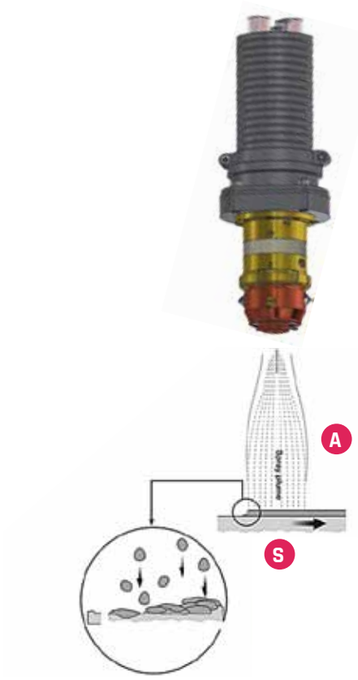
MATURE TECHNOLOGY

This technology enables a deposition of coating materials with a melting point up to 2,000° Celsius on highly sensitive substrates without any damage. It was developed to operate in minimum space requirements (7 × 7 × 17 cm) and a high energy output up to 17 kW.

The well thought out technology is designed for extraordinary easy and safe maintenance. The InoCoat was especially designed for serial operation, an efficient change of wear parts is thus granted.

The InoCoat plasma torch only weights 2.4 kg, so it can be used versatile. Depending on the application the coating speed can reach 500 mm/s. The distance **A** between substrate and nozzle is typically between 10-60 mm. The spraying width **S** is varying from 4 mm at micro range layers to 80 mm at nano range layers.





OUTPUT

MASS FABRICATION
FULLY AUTOMATED

SERIAL PRODUCTION
HIGHLY AUTOMATED

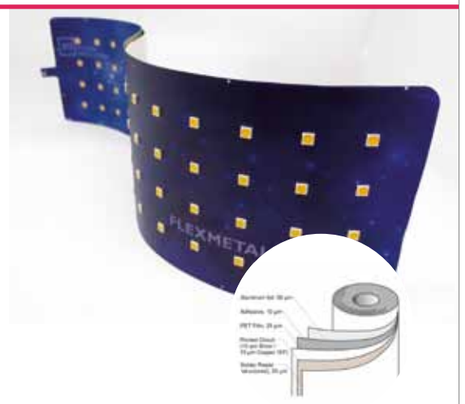
PROTOTYPING & SMALL SERIES
SEMI-AUTOMATED

The plasma torch (InoCoat) can be used differently depending on the focus. The coating technology is used both for complex research purposes as well as for targeted production. For this, InoCoat is the coating cell's core technology.

UNIVERSAL APPLICATIONS

ELECTRICALLY CONDUCTIVE PROPERTIES

In this functional coating, many metallic powders (e.g., Cu, Sn, Zn) can be partially applied to a variety of substrates (glass, metal, paper, polymer). In the process, a smooth or even textured coating can be done. The connection of electronic components can be executed by using metallic brazed joints, which is advantageous in comparison to fully conductive bonding on silver prints. The coating can be stored and the components can still be soldered even after longer storage.



ANTI-CORROSION COATINGS

These layers protect the substrate against corrosion. Using zinc layers, any metal can be coated. The created passive protection achieves identical results as electro-galvanised metals for a range of "salt spray endurance tests".

The layer thickness can be between 30–150 µm depending on the application. Different preparatory worksteps can increase the adherence of the plasma layer.

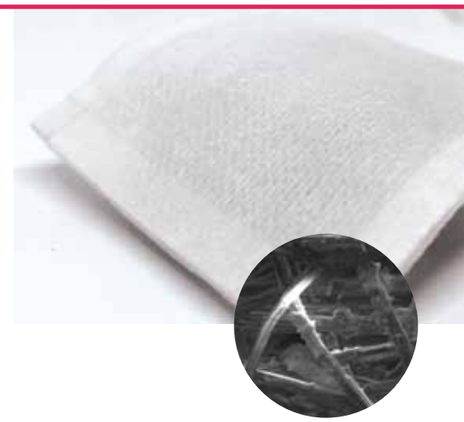
ADHESION ENHANCING PROPERTIES

For these invisible, glass-like layers, a layer thickness of up to 50 nm can be realised; furthermore surface energies of approx. >72 mN/m can be achieved. These partial coatings are suitable for optimising adhesive processes or printing processes.

These layers can also be used for the connection of unrelated materials such as metal/plastic. Significant improvements in transmittance are additional effects and are used e.g. for glass panes.

ANTI-BACTERIAL COATINGS

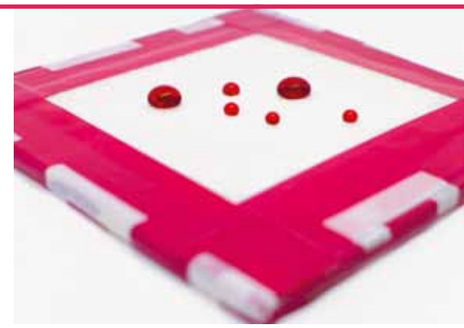
Metal salts or powder (zinc, copper etc.) are used for coating to create anti-bacterial properties on materials. Thanks to the plasma coating process, the base properties of the substrate are maintained (flexibility, suction power etc.) and a new functionality is added. No batch process is necessary, the coating will take place "in-line". Moreover, a partial application is no obstacle.



NON-STICK PROPERTIES

This silicone-like coating achieves surface energies of about 23 mN/m, which is close to Teflon, but without fluorine additives. What is more, layer thicknesses of up to 50 nm are possible per coating cycle.

The layers can be applied on top of each other (layer configuration). A further option is the creation of a multi-layer structure. Additionally, these layers can also have anti-bacterial properties.



CE Certification

Low equipping times

PlasmaPlotter version “3D”

TURNKEY INSTALLATION

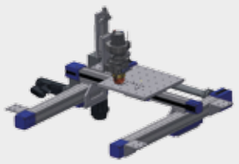
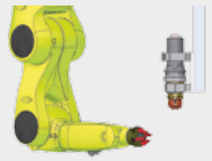
The PlasmaPlotter is a complete coating cell for a wide variety of challenges. The cell was designed as a **plug&play solution** and offers added value for both **complex research projects** as well as **production-based applications**. There is a wide variety of workpiece carrier systems available due to the diversified application options. For this either the compact plasma torch or the substrate is moved.

WELL THOUGHT OUT COATING CONCEPT

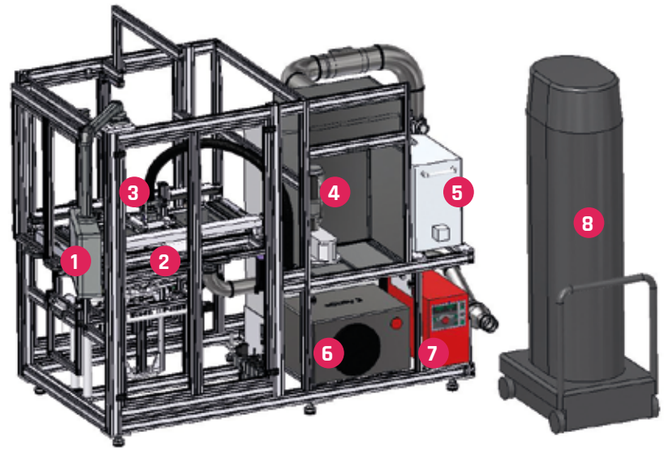
- Movable operating desk with touchscreen
- Visualisation of all machine components
- Parameter memory function
- Interfaces for data import and data export
- Process monitoring (voltage, current, torch cooling, powder sensor, flow speed monitoring extraction system)
- Simple movement control (G-code)

PlasmaPlotter version “volume”

INDIVIDUAL ASSEMBLING PLASMAPLOTTER

STANDARD	VOLUME	3D
Dimensions: 2,000 × 1,000 × 1,900 mm	Dimensions: 2,300 × 1,400 × 2,100 mm	Dimensions: 2,000 × 1,500 × 2,300 mm
Weight: approx. 600 kg	Weight: approx. 1,500 kg	Weight: approx. 1,000 kg
Substrate size: 420 × 300 mm	Substrate size: 420 × 300 mm	Substrate size: 420 × 300 × 30 mm
WORKPIECE CARRIER SYSTEMS	**WORKPIECE CARRIER SYSTEMS**	**WORKPIECE CARRIER SYSTEMS**
		
The workpiece carrier system moves the substrate in the X and Y axis. The plasma torch is fixed and can be adjusted manually in the Z level. Idea: The movement space of the “standard” version is perfectly suited for various research and layer development tasks.	The substrate is inserted/ supplied using various methods. “Roll to roll” as well as other automated applications are possible. The plasma torch moves on the X and Y axis. The small scale coating chamber allows clean and safe working even in fully automatic mode. Idea: The “volume” has been developed both for the prototype development as well as for the automated operation.	The workpiece carrier system can also move the substrate three-dimensionally. The plasma torch is fixed. It is also possible to coat rotation symmetrical components using suitable clamping device. The plasma torch can also be fitted to the robot arm. Idea: The “3D” version was specifically designed for complicated substrate forms.

MODULAR DESIGN

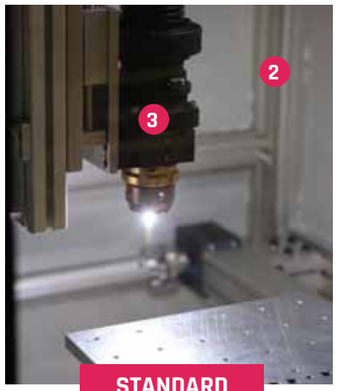


Technological compilation by the example of “volume”

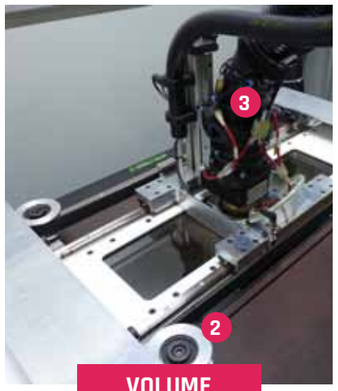
1. Control panel
2. Coating chamber
3. Plasma torch
4. Powder feeder
5. Evaporator
6. Cooling system
7. Power source
8. Aspiration system

The components 1 & 2 are different depending on the version.

3 – 8 are identical for each version and can vary as required.



STANDARD



VOLUME

3D

AS A RESULT OF THE MODULAR DESIGNED MACHINE, COMBINED WITH THE DIFFERENT WORKPIECE CARRIER SYSTEMS, HIGHLY INDIVIDUAL COATING SOLUTIONS ARE TANGIBLE.

VERIFICATION

The verification of the surface coating is done differently depending on requirements. In cooperation with research institutions, the results are validated and released. Since 2012, INOCON has been researching on functional layers and has been testing the results for stability, adhesion, functionality etc. as per existing standards.

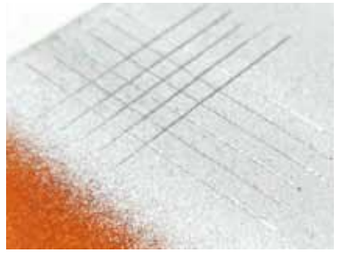
1

Comparison of a **wet-chemical corrosion protection layer** and the **atmospheric corrosion protection layer** by INOCON.

Endurance salt spray test DIN EN ISO 9227, removal after 0 h, 240 h, 480 h. No differences can be seen with regards to rust formation.

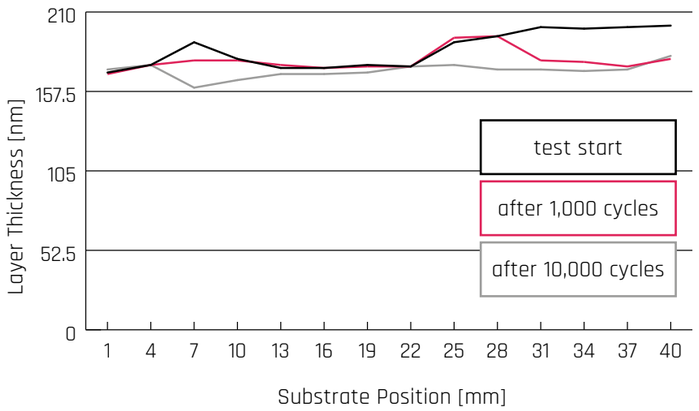
2

The **adhesive strength** of the zinc layer is checked with the cross cutting test DIN EN ISO 2409.



3

Extract of a HMDSO layer on glass.
The coating was successfully verified with a “washability” as per ASTM D2486 test.



INOCON is developing new surface properties together with **external partners** within the scope of national and international joint research projects.

“The plasma coating technology opens up completely new production and research & development opportunities. The compact and user-friendly construction of the atmospheric coating cell helps us to achieve a competitive edge and to generate added value.”

DIPL. ING. WOLFGANG HACKL BSC
New Business Development Printing Technology

“INOCON – the partner you have been looking for: experienced, innovative, flexible and reliable.”

DR. ULRICH-ANDREAS HIRTH
Global Head of Business Development

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