

COMPENDIUM



*Advanced Coating Systems*  
**openSource**

## **PLATIT Compendium**

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# About us



WELCOME



PLATIT is a leading manufacturer of high-tech PVD and PECVD coating units for tools and machine components. The company is part of the family-owned BCI Blösch Group, an independent Swiss technology group. PLATIT is headquartered in Selzach (Switzerland) and has its own service, support and sales offices in Europe, North America and Asia. These are complemented by a broad network of distributors and partners worldwide. PLATIT has installed over 550 coating systems and maintains close partnerships with its customers.

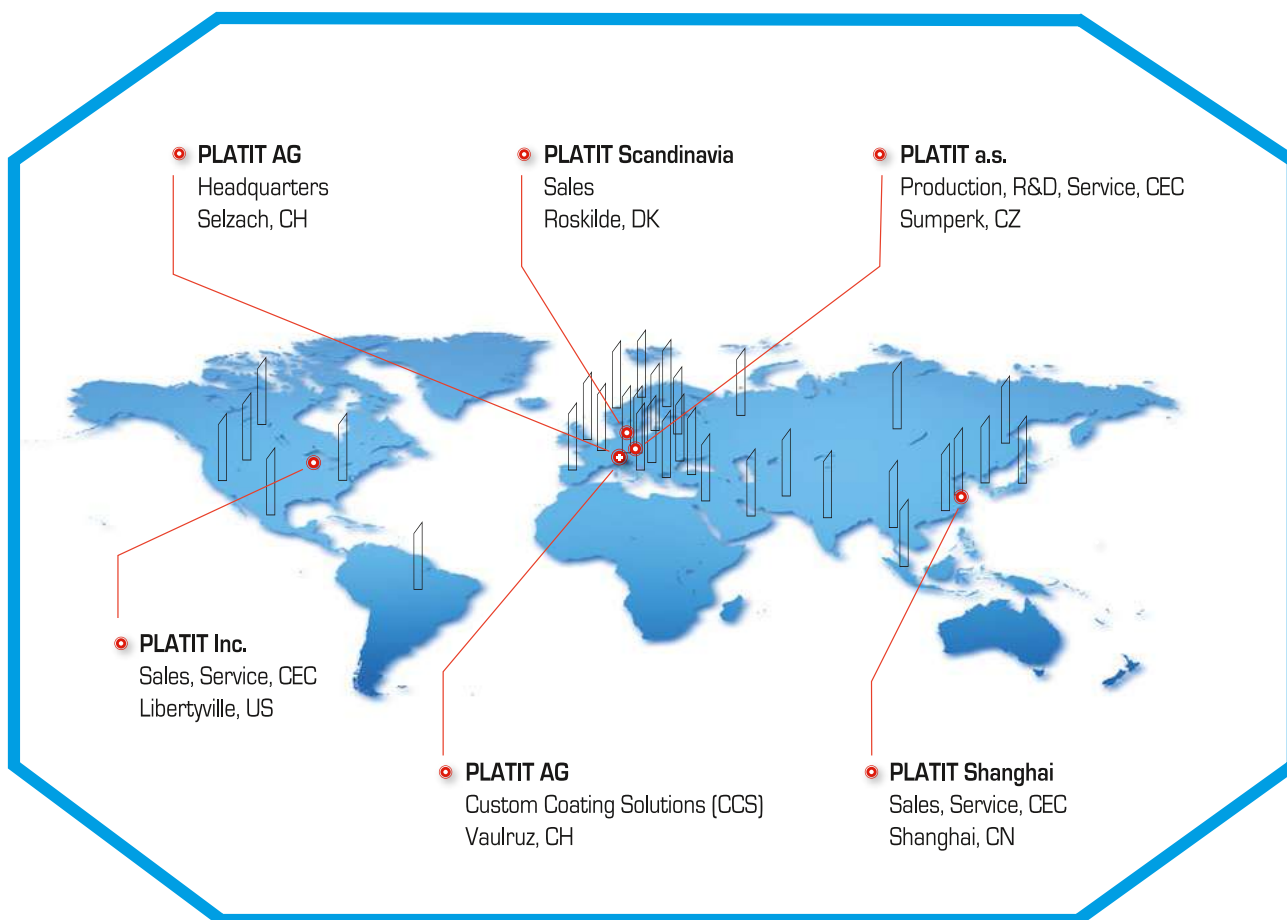
The variety of tool geometries and applications requires manufacturers of coating equipment to offer a wide range of technical solutions to best fulfill customers' needs. PLATIT offers numerous high-tech standard and custom coating solutions with modular machine designs, high flexibility and good user-friendliness. Profound competencies in cathodic ARC, SPUTTER and HiPIMS technology allows PLATIT to integrate these technologies into hybrid processes, creating solutions for different applications. PLATIT's open-source philosophy allows customers to adapt coatings to their specific requirements and individual needs. With the highest coating performance in dedicated application fields, PLATIT customers can differentiate themselves from the market standard.

In addition to coating units, PLATIT offers turnkey systems as part of its product portfolio. These include complete solutions for upstream and downstream steps such as decoating, edge pre-treatment, cleaning, post-treatment and quality control, making PLATIT systems ideally suited for seamless integration into the tool manufacturing and regrinding process.



**Headquarters** Selzach Switzerland

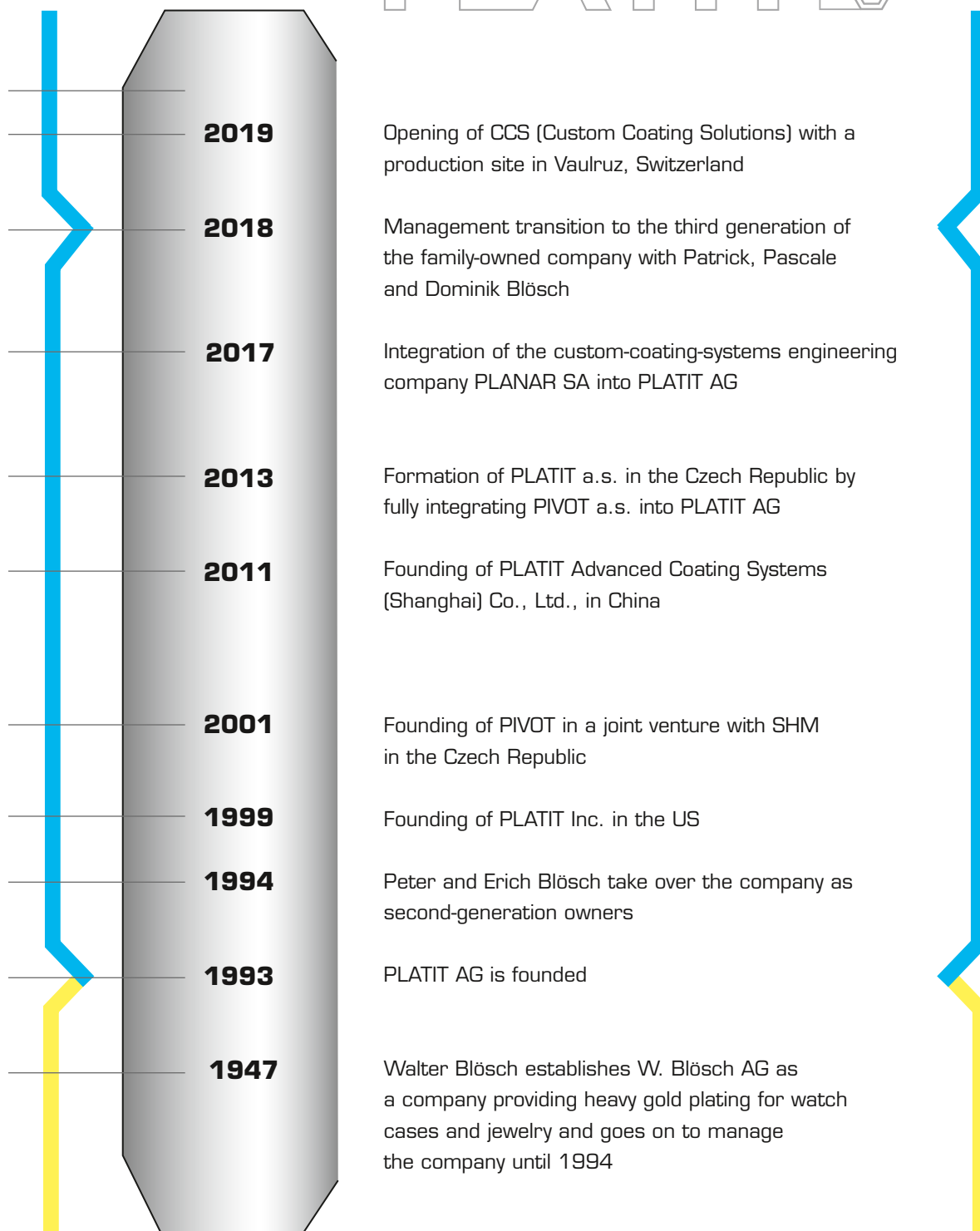
## GLOBAL PRESENCE



PLATIT has installed coating systems for customers in 39 countries around the world.



## COMPANY MILESTONES

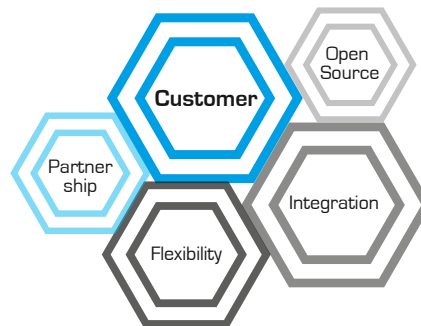


## RESEARCH AND DEVELOPMENT MILESTONES



Release of ta-C coatings in Pi411	<b>2020</b>
PL2011: Custom Coating Solution for saw blades	
Mega-PiMS: Custom Coating Solution for rollers and broaches	
Release of the new generation of the Pi111 Smart Speed Unit	
Market launch of the PL711 with the PLATIT 3D module and DLC processes (a-C:H:Si and ta-C)	<b>2019</b>
S-MPuls: Custom Coating Solution for punches	
Release of the new generation of the Pi411 with additional hybrid LACS® technology (Lateral ARC with Central SPUTTERING) with simultaneous ARC and SPUTTER processes	<b>2017</b>
Release of the new generation of the PL1011 High Volume Unit	<b>2016</b>
Market launch of the Pi111	
Market launch of the Pi1511	<b>2015</b>
Introduction of the new PLATIT SmartSoftware	
Market launch of the ultra-fast CT20 decoating system	<b>2014</b>
Market launch of the Pi411 with SCIL® (SPUTTERED Coating Induced by Lateral Glow Discharge)	<b>2013</b>
Pi603: Custom Coating Solution for saw bands	<b>2012</b>
Introduction of LGD® (Lateral Glow Discharge), new PLATIT etching technology	<b>2011</b>
Market launch of the PLATIT 11-Series with the Pi111	<b>2010</b>
Release of DLC2 (PECVD) processes (a-C:H:Si)	<b>2009</b>
First coating unit with LARC® and CERC® (Central Rotating Cathode): Pi300	<b>2005</b>
First coating unit with plug-&-play functionality: PL1001	<b>2004</b>
First coating unit with rotating LARC® (Lateral Rotating Cathode) and nanocomposite coatings: Pi80	<b>2003</b>
PL2001: Custom Coating Solution for saw blades	
Market launch of PLATIT Turnkey Solutions	<b>2000</b>
First PLATIT PVD hard coating unit: PL1000	<b>1993</b>

## WHAT WE STAND FOR



**Core competencies of PLATIT include integration, flexibility, open-source technology and strong customer relationships.**

**Integration** enables in-house coating. Based on our comprehensive understanding of the manufacturing and regrinding of tools, we develop optimized solutions for our customers, which we seamlessly integrate into their existing production process.

**Flexibility** refers to our business model and our products. Our PVD standard coating units are based on a modular design. With different implemented technologies, they can produce a variety of coatings and even deposit complex layers. The coating units are ideally suited for the development of customized coatings and ensure that our customers can set themselves apart from their competitors by creating their own brand image. Furthermore, the Custom Coating Solutions division integrated into our dual business model gives us the flexibility to build customized PVD systems dedicated exclusively to a single use or purpose.

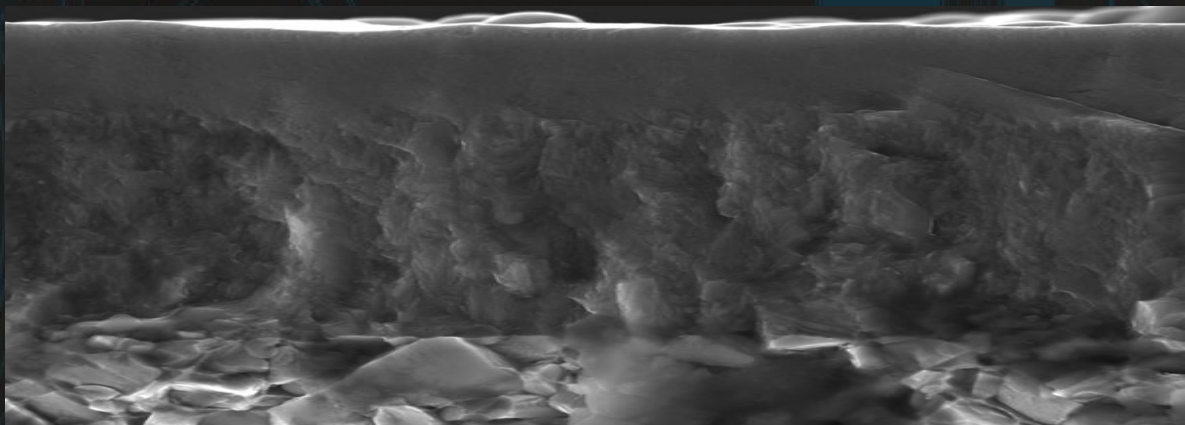
**Open-Source** technologies inspire innovations. By purchasing our technology, customers can participate in our know-how. Our systems are open to engineers, their parameters and recipes can be manipulated and further developed if needed. We also value interactions, discussions and sharing knowledge with technology users, as we firmly believe that both parties benefit from transparency and openness.

We believe in **strong customer relationships**, ensuring our customers are always satisfied. We stand by our customers with worldwide service, support and sales offices as well as with our partners for upstream and downstream processes. Our customers benefit from our network, which matches supply with demand for tool manufacturers, regrinders and coating centers. As a premium provider, we assist our customers in customer acquisition: we provide support from sampling to the adaptation of coatings resulting in innovations. PLATIT does not offer job coating services and therefore avoids entering into competition with its customers.



## PLATIT COATING INTELLIGENCE

— THE COATING



PLATIT® *11* - Series

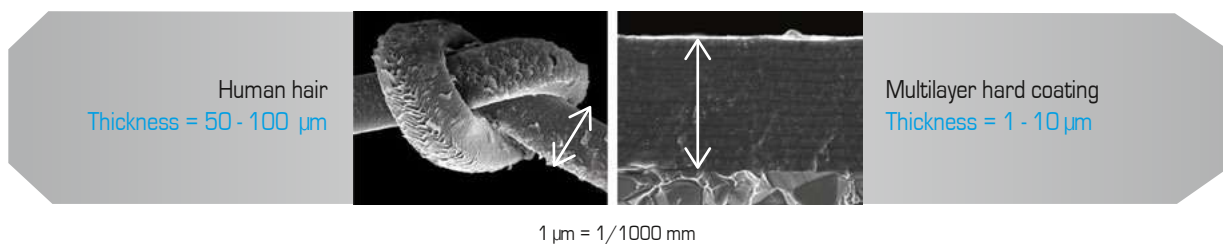
## PVD HARD COATING

A coating is a thin protective film intended to improve the surface properties of a base material in terms of:

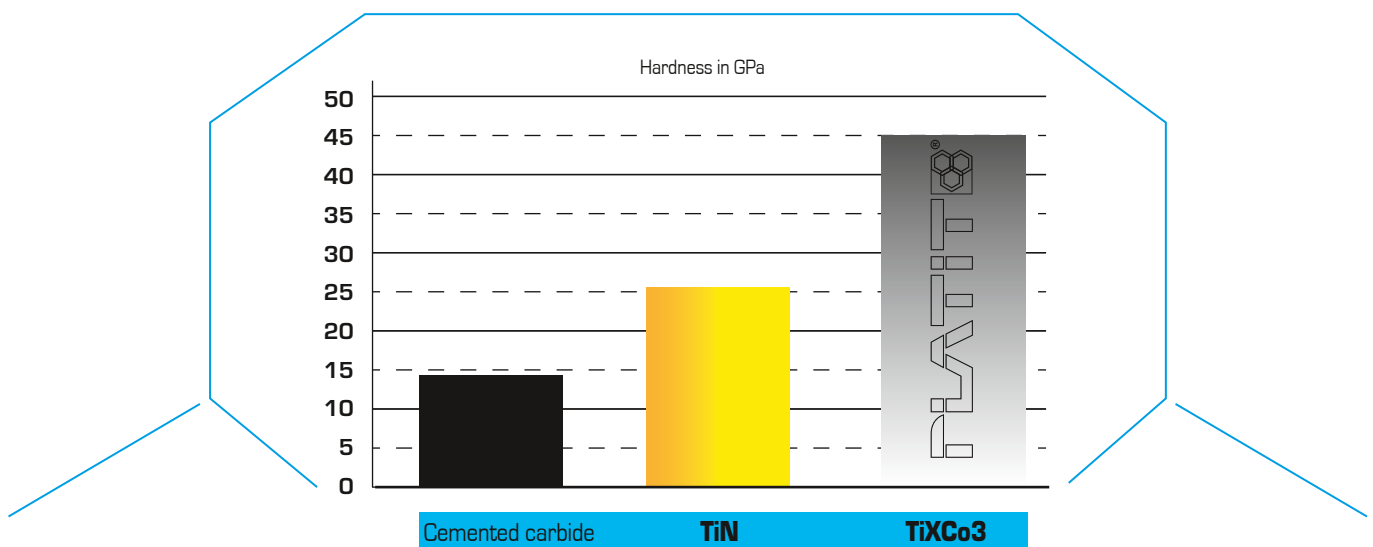
- Hardness
- Oxidation resistance
- Friction
- Fracture toughness
- Chemical stability

For example, the coating on a cutting tool allows for faster cutting speeds, resulting in higher productivity and a longer lifespan of the base material.

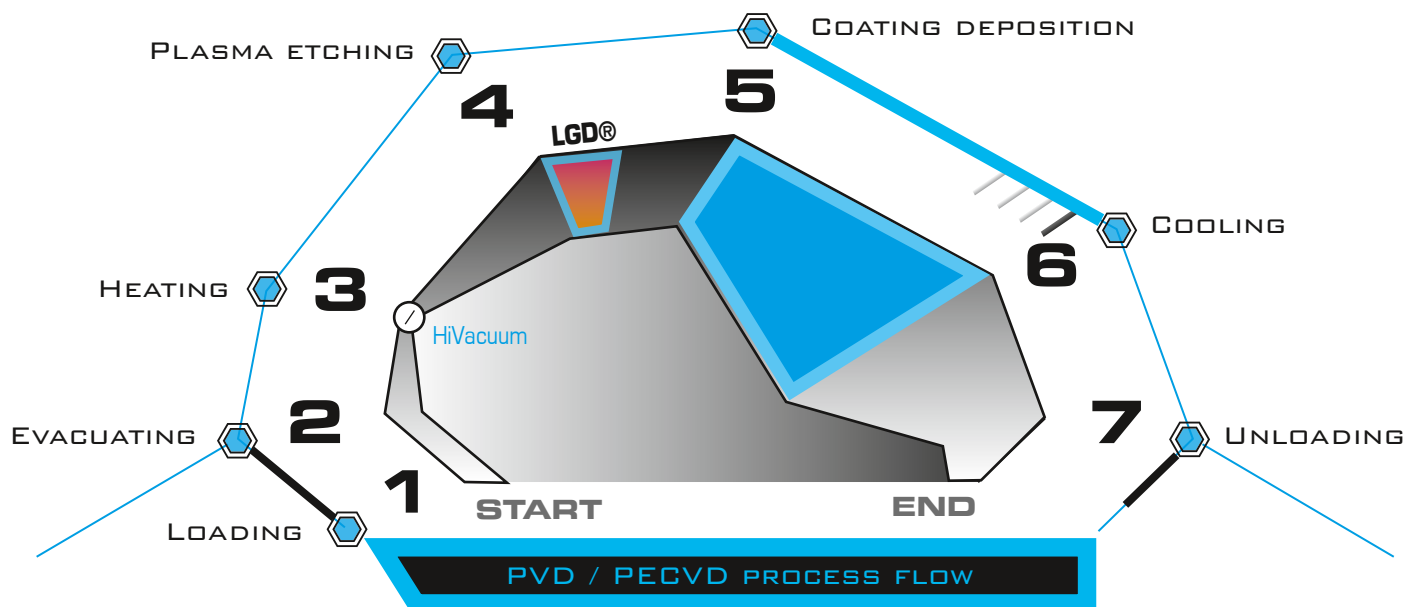
### Comparison between a human hair and hard coating:



### Comparison of hardness from the softest to the hardest material:



## COATING PROCESS



PLATITITE®

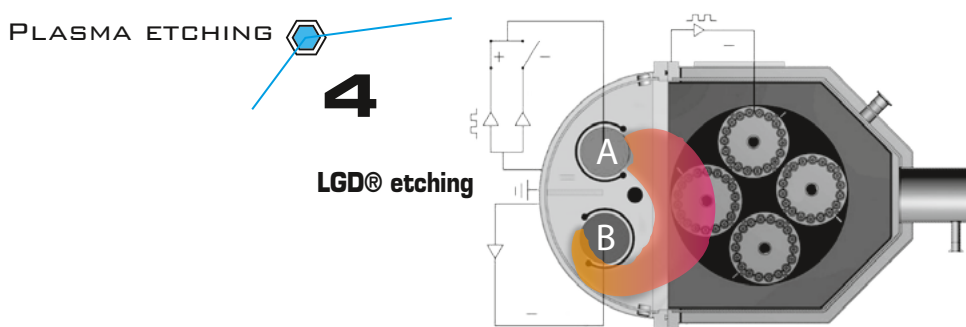
1. The coating chamber is loaded
2. A high vacuum is required for depositing PVD coatings.  
The evacuation in PLATIT coating units takes place in two steps:
  - 2.2 The rotary-vane pump generates an inlet pressure in the chamber from 100 to  $10^{-2}$  mbar
  - 2.3 The turbomolecular pump generates a high vacuum of approximately  $1 \times 10^{-5}$  mbar
3. The chamber is heated up.  
Process temperatures are about 150 - 500°C
4. PLATIT coating units work with three different etching processes:
  - 4.2 LGD® (Lateral Glow Discharge)
  - 4.3 Plasma etching with argon, glow discharge
  - 4.4 Metal ion etching (Ti, Cr)
5. Coating deposition with PVD (ARC, SPUTTER or hybrid LACS® technology) or PECVD processes
6. Cooling of the coating chamber
7. The coating chamber is unloaded

## LGD® ETCHING

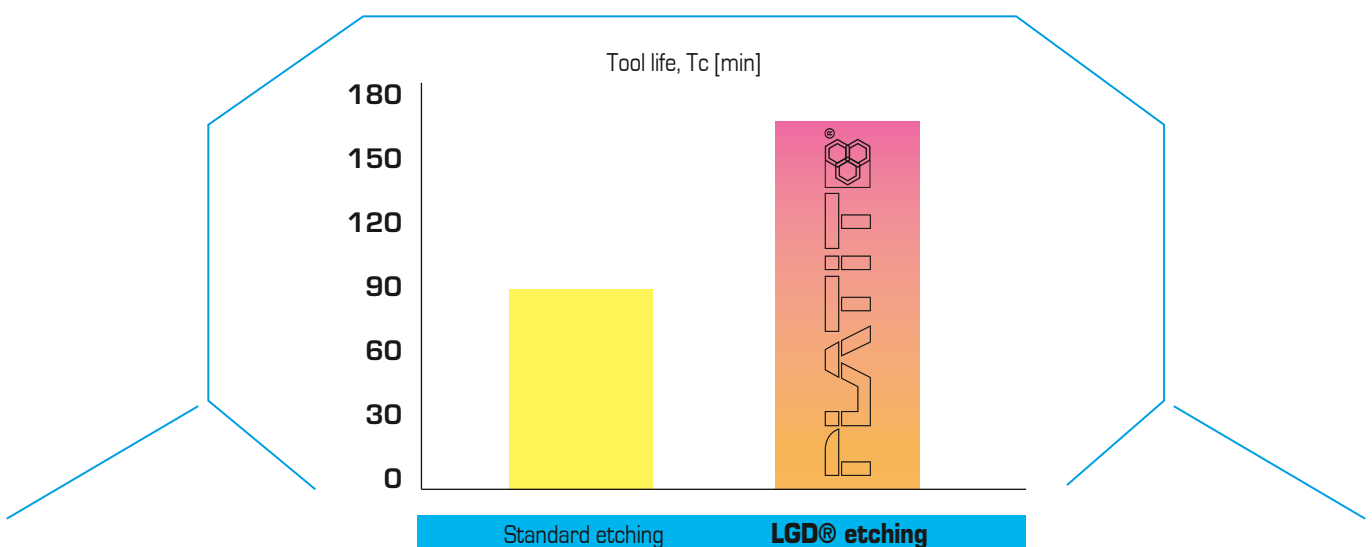
LGD® (Lateral Glow Discharge) is the patented etching process in PLATIT's coating units. It takes place before the coating process. Thanks to plasma with high ion density generated by an electron flow between two cathodes, LGD® can process even complex surfaces and cavities as well as cutting-edges and corners (e.g. of hobs, molds and dies).

Use of shutters:

- Targets are cleaned by igniting an ARC behind the shutter on the target surface without contaminating the tools
- The shutter is opened after the cleaning process of the target, which creates ideal conditions for optimal coating adhesion



### Comparison of different etching methods:



Tool: milling head, z = 4; insert ADMX 11T308SR  
 Cooling with emulsion; ap = 8 mm; ae = 22 mm; vc = 80 m/min, f = 0.1 mm/rot  
 TiAlN 1x with LGD® and 1x plasma etching with argon

# Coating technologies

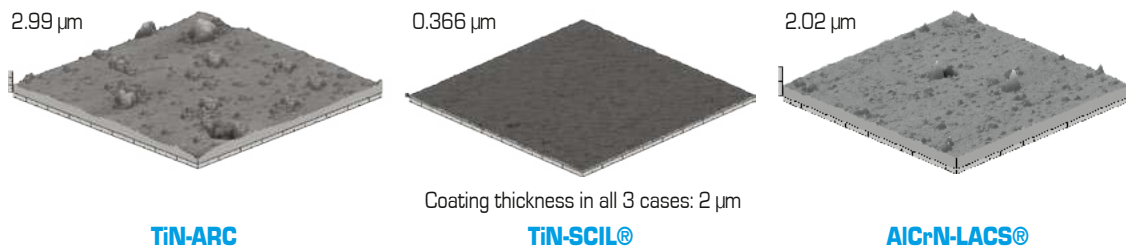


## OVERVIEW

Coatings are usually deposited using ARC or SPUTTER technology. PLATIT hybrid LACS® additionally offers a fusion of technologies unique in the coating world.

ARC	SPUTTER	PLATIT® HYBRID
<b>ARC technology</b>	<b>SPUTTER technology</b>	<b>Simultaneous ARC- and SPUTTER processes</b>
Common way of coating cutting and forming tools	Common for decorative coatings and micro-tools	PLATIT's patented hybrid LACS® technology combines the advantages of LARC® cathodes with those of central SPUTTERING SCIL®
With ARC technology, primarily conductive materials such as metals are used as targets	Targets with low thermal conductivity such as pure ceramics can also be SPUTTERED	Introduction of "new" materials through the SPUTTERING of ceramics
High degree of ionization	Low degree of ionization	High degree of ionization
Excellent adhesion	Improved adhesion through SCIL® (SPUTTERED Coating Induced by Lateral Glow Discharge) or through the PLATIT 3D module	Excellent adhesion
High deposition rate	High deposition rate thanks to SCIL®	Higher deposition rate than with SPUTTERING only, but lower than with ARC only
Droplets increase surface roughness (Sa ~ 0,2 µm; Sz ~ 2,1 µm)	Smooth surface free of droplets and defects (Sa ~ 0,02 µm; Sz ~ 0,3 µm)	Superior surface quality compared to ARC (Sa ~ 0,1 µm; Sz ~ 1,6 µm)

### Comparison of the surface:



## ARC WITH ROTATING CATHODES

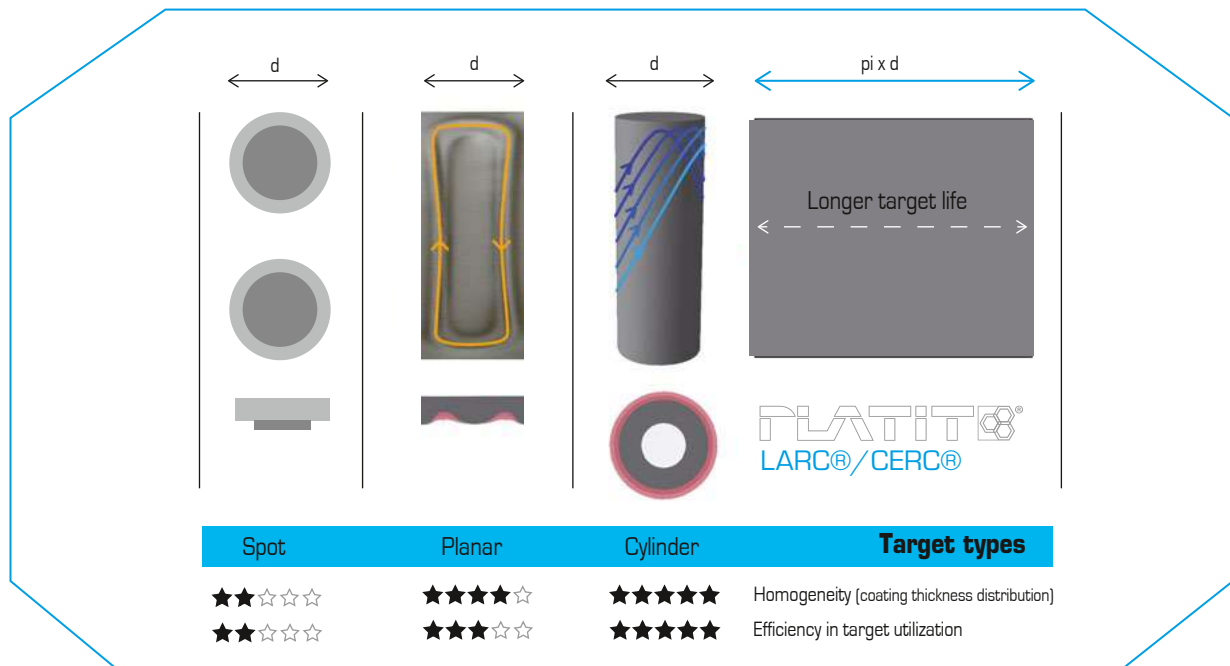
LARC® and CERC® are PLATIT's trademarked brand names for rotating cylindrical cathodes inside the door and at the center of the coating chamber using ARC technology for deposition.

The working principle of all PLATIT Pi coating units is based on the revolutionary LARC® cathodes (Lateral Rotating Cathode). The Pi411 is upgradable with a CERC® (Central Rotating Cathode).

Compared to conventional cathodes, rotating cathodes have several advantages:

- Flexibility in programming the coating composition of unalloyed targets
- A larger effective target surface area ( $\pi \times d$ ) at a constant target length  $h$  ( $\pi \times d \times h$ ) prolongs target lifetime
- Excellent process control and stability
- Improved coating adhesion through LGD® etching (Lateral Glow Discharge)
- Homogeneous vertical coating thickness distribution in the chamber

### Target performance comparison:



## SPUTTER TECHNOLOGY SCIL®

The PLATIT coating unit Pi411 uses the patented SCIL® technology (SPUTTERED Coating Induced by Lateral Glow Discharge) to achieve high deposition rates with SPUTTERING.

SCIL® allows for high-performance SPUTTERING from the central cathode. The cathode consists of:

- Cathode body, including magnetic coils with up to 30 kW of SPUTTERING power
- Perforated pipe for coolant inlet
- Membrane pipe tensed by internal cooling water for good conductivity to the target rings
- Metal or ceramic target rings

### Setup SPUTTER cathode SCIL®:



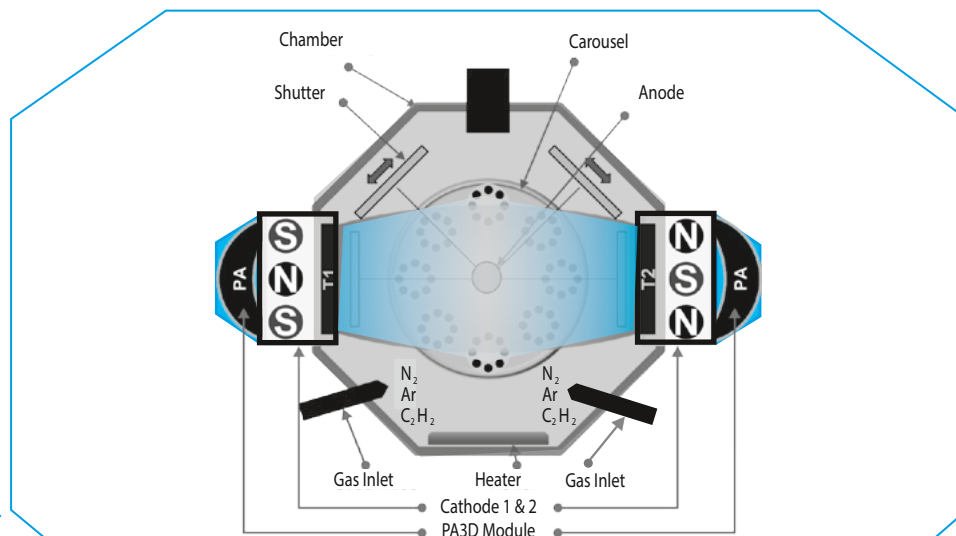
PLATIT®

## PA3D SPUTTERING

The PLATIT 3D module (newly developed Helmholtz system) is used in the coating unit PL711 to offer the following advantages over conventional SPUTTER technology:

- High plasma density concentrated in the carousel
- No plasma deadlock zones
- No hollow cathodes
- Minimal cleaning effort after DLC processes necessary
- Higher deposition rates with uniform coating homogeneity
- Stable coating processes < 0.1 Pa
- Improved etching efficiency, stable etching processes < 0.2 Pa
- Variable magnetic field strength in the SPUTTER cathodes

**PLATIT 3D Module:**



PLATIT®



## HYBRID LACS<sup>®</sup> TECHNOLOGY

Hybrid LACS<sup>®</sup> technology (Lateral ARC with Central SPUTTERING) with simultaneous ARC and SPUTTER processes combines the advantages of LARC<sup>®</sup> cathodes with those of central SPUTTERING SCIL<sup>®</sup>:

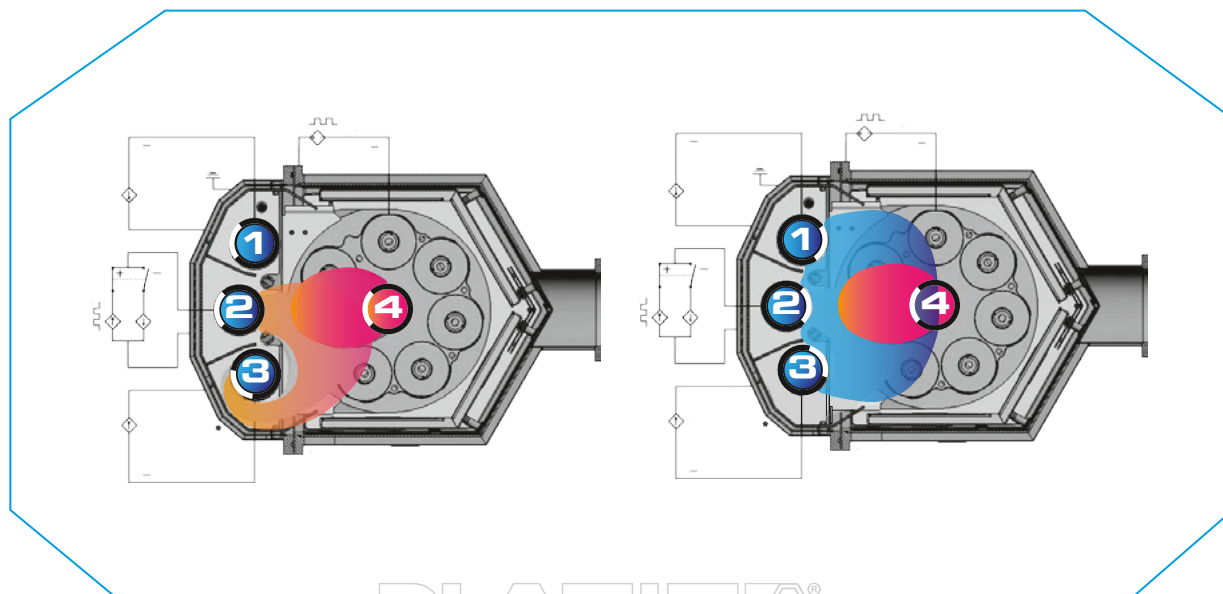
- High ion density, excellent adhesion
- High deposition rates
- Introduction of “new” materials by SPUTTERING of ceramic targets
- Smoother coatings

Two different types of this hybrid technology can be applied in the Pi411 coating unit:

**Simultaneous deposition by LGD<sup>®</sup>** (Lateral Glow Discharge) & **SCIL<sup>®</sup>** (SPUTTERED Coating Induced by Lateral Glow Discharge) to increase ion density and affect the coating properties of SPUTTER coatings

**Simultaneous deposition by LARC<sup>®</sup>** (Lateral Rotating Cathode) & **SCIL<sup>®</sup>** with the combination of ARC evaporation and SPUTTERING for targeted doping of coating components

### PLATIT hybrid processes:



PLATIT<sup>®</sup>

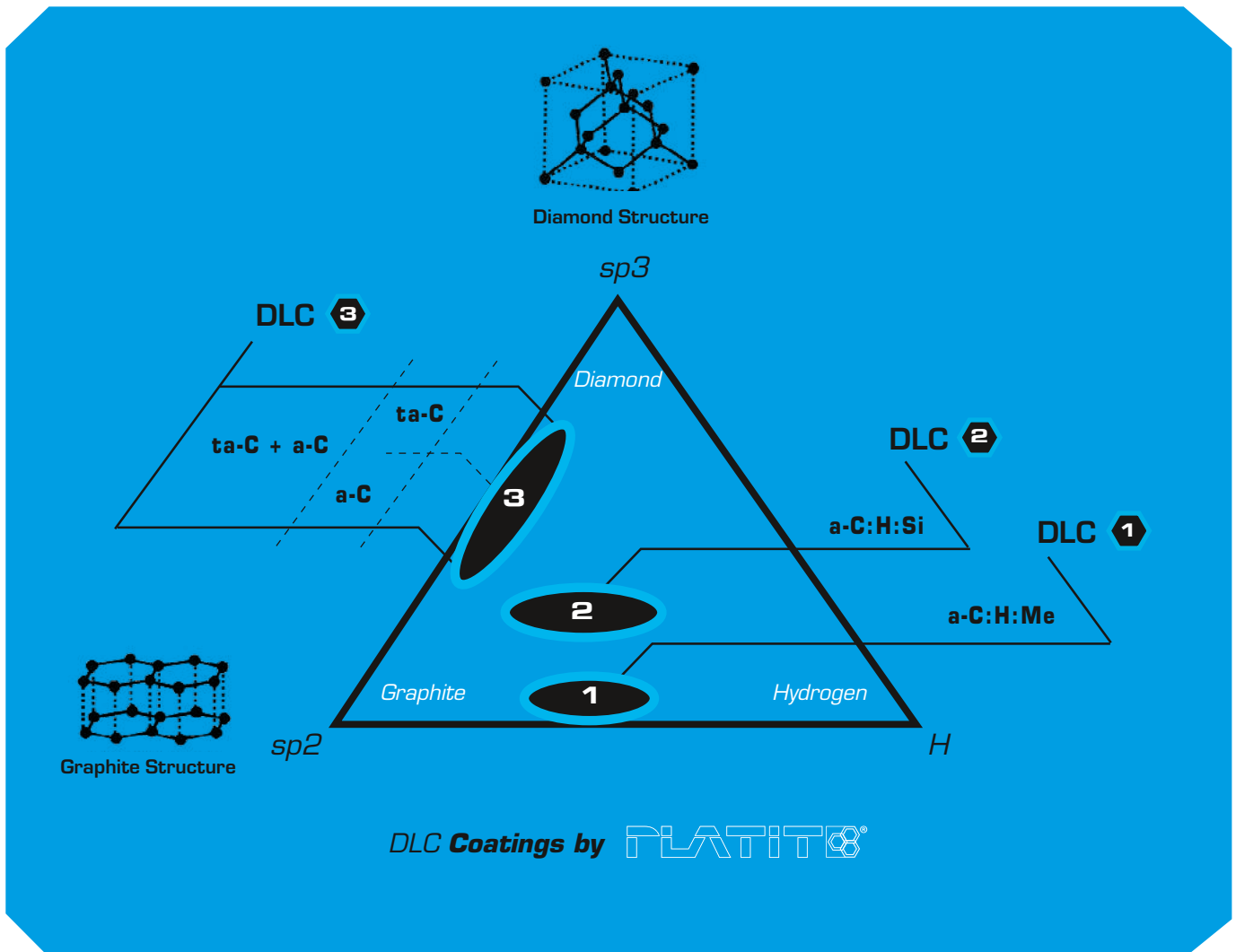


## DLC TECHNOLOGY

DLC (diamond-like carbon) is a metastable form of diamond-like amorphous carbon with a significant amount of  $sp^3$  bonds.

Properties and application possibilities:

- Smooth surface
- High mechanical hardness
- Chemical resistance
- Low coefficient of friction between the tool and the workpiece
- Non-reflective surface
- Suitability for biocompatible products



## DLC OVERVIEW

DLC coatings are divided into the following categories:

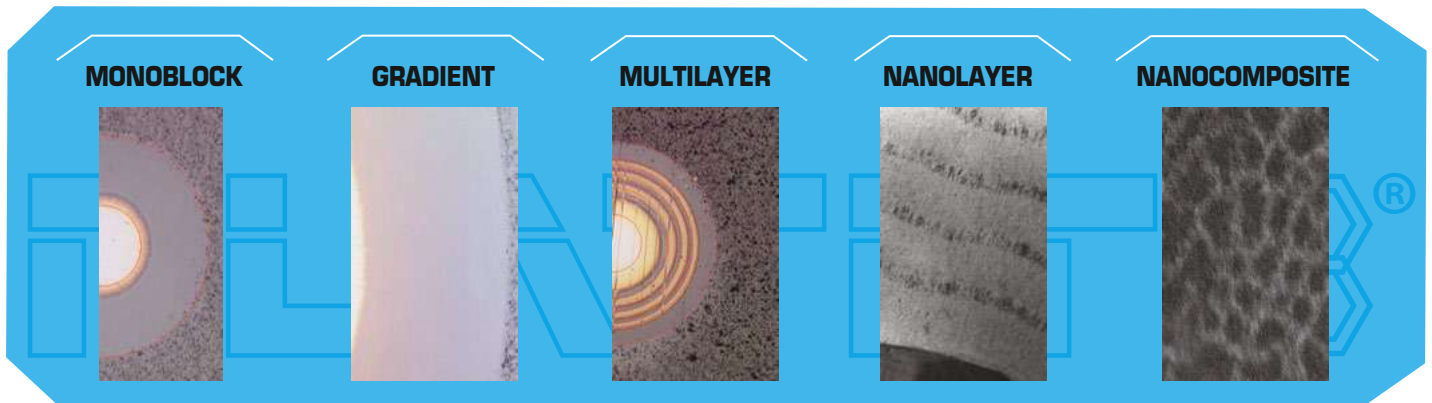
- a-C = hydrogen-free amorphous carbon
- ta-C = tetrahedrally bound hydrogen-free amorphous carbon
- a-C:Me = metal-doped hydrogen-free amorphous carbon (Me = Ti)
- a-C:H = amorphous carbon with hydrogen
- ta-C:H = tetrahedrally bound amorphous carbon with hydrogen
- a-C:H:Si = Si-doped amorphous carbon with hydrogen
- a-C:H:Me = metal-doped amorphous carbon with hydrogen (Me = W, Ti)

Comparison of the most important properties of PLATIT DLC coatings:

PLATIT®	DLC 1	DLC 2	DLC 3	
PLATIT coating unit	Pi411 PL1011	Pi411 PL711	Pi411	PL711
Composition	a-C:H:Me	a-C:H:Si	ta-C + a-C (over 50 % ta-C)	ta-C + a-C (up to 50 % ta-C)
Process	ARC in C <sub>2</sub> H <sub>2</sub> atmosphere	PECVD	SPUTTERING	SPUTTERING
Coating architecture	As top layer	As stand-alone or as top layer	As stand-alone	As stand-alone
Doping	Ti or Cr	Si	None	None
Coating thickness [µm]	< 1 *	< 3	0,3 - 1	1 - 2
Young's modulus [GPa]	200*	250	350 - 450	350 - 450
Nano-hardness [GPa]	< 20*	> 25	45 - 50	> 30
Roughness	Ra ~ 0.1 µm* Rz ~ coating thickness*	Ra ~ 0.03 µm Rz ~ coating thickness	Ra ~ 0.06 µm Rz ~ coating thickn.	Ra ~ 0.02 µm Rz ~ coating thickn.
Coefficient of friction [µ]	~ 0.15*	~ 0.1 - 0.2	~ 0.1	~ 0.1
PoD (at RT, 50 % humidity)				
Max. service temperature [°C]	400	400	450	450
Coating temperature [°C]	< 400	< 220	< 150	180 - 250
Main application	Improvement of the run-in proces of a tool, lubrication by formation of transfer films	Components, punches and dies	Tools	Components

\*As a top layer

## OVERVIEW



### Monoblock-Coating(MB)

Monoblock (MB) consists of a single layer of nitride. This single layer can be applied on an adhesion layer (e.g. TiN+AlTiN-MB). If the adhesion layer and monoblock do not differ, the coating process does not switch between different target materials.

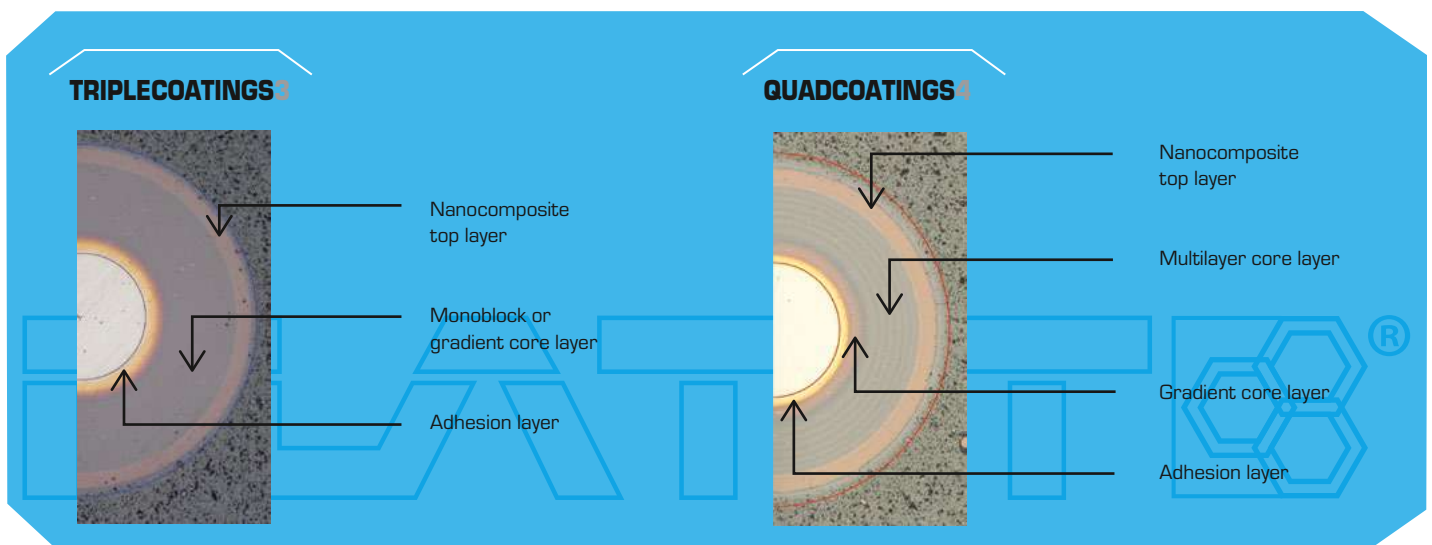
### Gradient structure (G)

occurs if the composition in the coating continuously changes. The coating consists of an adhesion and a core layer. A typical G coating is TiAlN/AlTiN-G.

**Multilayer (ML)** also consists of an adhesion and a core layer. After the adhesion layer, several (multiple) layers are deposited in succession. These multiple layers create a sandwich structure that absorbs the cracks in the sublayers. The coating is tougher but not as hard as a monoblock. The thickness of a single layer in ML is typically 50 - 100 nm, as for example in AlCrN-ML.

**Nanolayer (NL)** is a finer version of a multilayer with a layer thickness of < 20 nm. Coating hardness depends on the coating thickness period. To increase the hardness, a period of approx. 10 nm should be set. All PLATIT coatings with metallic targets have a NL structure.

**Nanocomposites (NC)** consist of an adhesion and a core layer. The core layer consists of 2 phases: hard, nanocrystalline grains (e.g. TiN, TiAlN or AlCrN grains) are embedded in an amorphous SiN matrix, which prevents the grain from growing and creates the nanocomposite structure. Column growth is prevented and a fine crystalline / amorphous structure is formed. One example is nCo.

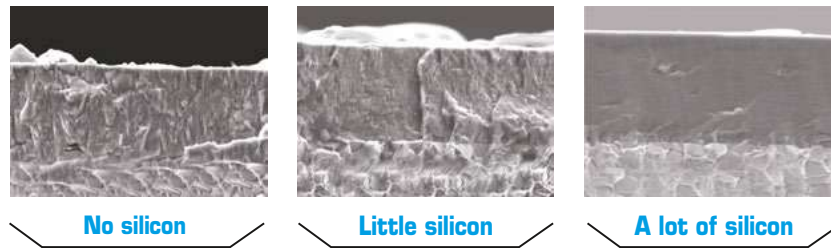


**TripleCoatings3** from PLATIT consist of an adhesion layer, a core layer (MB or G) and a nanocomposite top layer. A typical coating is nCo, available with the Pi411 coating unit.

**QuadCoatings4** from PLATIT receive a fourth block for special purposes in addition to the triple structure. These coatings consist of an adhesion layer, a first core layer of the gradient type, a second core layer of the multilayer type and a nanocomposite top layer. A typical example is TiXCo4.

## NANOCOMPOSITE

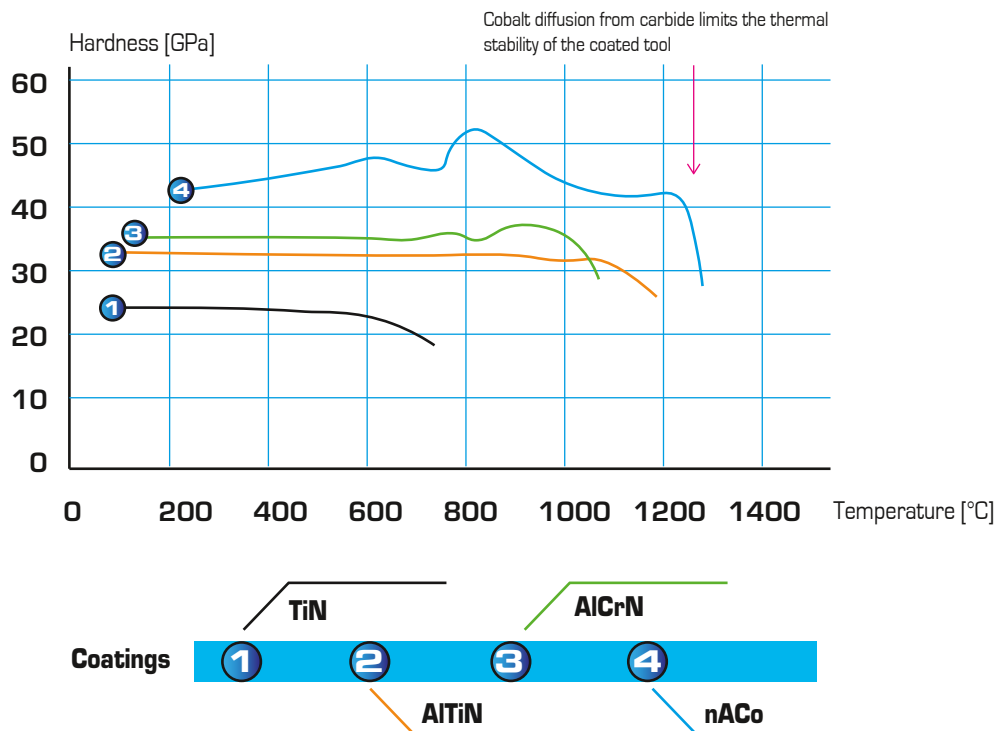
Hardness comparison:



A comparison with sand on a beach can serve to illustrate the increase in hardness achieved by the nanocomposite structure: normally, a person's foot will sink into dry sand. If the sand is wet, their foot will not sink in as far, because the space between the grains is filled with water. The surface has a higher resistance and is therefore harder.



Heat resistance comparison:



## INFLUENCE OF DIFFERENT ELEMENTS

Influence of different elements on the properties of a coating with TiN or CrN as a reference:

Comparison	Coating	Hardness	Friction	Structural stability	Oxidation resistance	Wear resistance at 23 °C	Wear resistance at 600 °C
Chrome (CrN) compared to titanium (TiN)		∅	+	-	∅	++	+
+ Aluminum (Al)	AlTiN or AlCrN	+	-	+	+	∅	++
+ Silicon (Si)	nACo or nACRo	++	∅	++	+	+	++
+ Boron (B)	BorAC	++	∅	+	+	+	++
+ Carbon (C)	TiCN	++	++	-	-	++	-
+ Oxygen (O)	nACoX	-	∅	++	++	-	+

- ∅ No change
- + Positive change from the user's perspective
- ++ Very positive change from the user's perspective
- Negative change from the user's perspective
- Not suitable for this purpose



PORTFOLIO

PLATIT® *11* - Series



PLATIT offers high-tech PVD and PECVD coating units. Depending on the requirements, we equip them with the following technologies:

- ARC in DC or pulsed mode
- SPUTTER in DC, pulsed or HiPIMS mode
- Hybrid technology with simultaneous ARC and SPUTTER processes

The focus of PLATIT is on the tool and machine component field, but we also manufacture tailor-made Custom Coating Solutions for special requirements.

### PVD standard coating units

PVD standard coating units from PLATIT are perfectly suited for coating tools and machine components of standard market sizes. They allow for short cycle times with high-quality coatings and can be flexibly programmed with different coating structures. Standard coating units can deposit PVD and PECVD for various nitride, oxide and DLC coatings.

PLATIT® 11-Series	Pi111	Pi411	PL711	PL1011	Pi1511
Max. coating volume [mm]	ø 353 x H 498	ø 540 x H 500	4 x ø 225 x H 800	ø 715 x H 805	ø 715 x H 805
Max. load [kg]	160	200	250	400	400
Load and cycle times of shank tools (2 µm): ø 10 x 70 [mm]	288 pcs., 4.5 h	504 pcs., 4.5 h	540 pcs., 11 h, with CrN	1008 pcs., 7 h	1080 pcs., 7 h
ARC technology	2 x LARC® PLUS cathode	3 x LARC® cathode, upgradable with 1 x CERC® cathode	-	4 x Planar cathode	3 x LARC® XL cathode, 2 x Planar cathode
SPUTTER technology	-	Upgradable with 1 x central SCIL® cathode	2 x Planar cathode	-	-
Hybrid-LACS® technology with simultaneous ARC & SPUTTER processes	-	Yes, upgradable	-	-	-
DLC	-	Upgradable for ta-C sputtered (DLC3) and for PECVD (DLC2)	PECVD (DLC2) and ta-C sputtered (DLC3)	-	-
OXI	-	Upgradable for oxide coatings	-	-	-



# 11-Series



STANDARD COATING UNITS

111

411

PLATIT® 11 - Series

711

1011

1511

# Smart Speed Unit



PLATIT COATING INTELLIGENCE

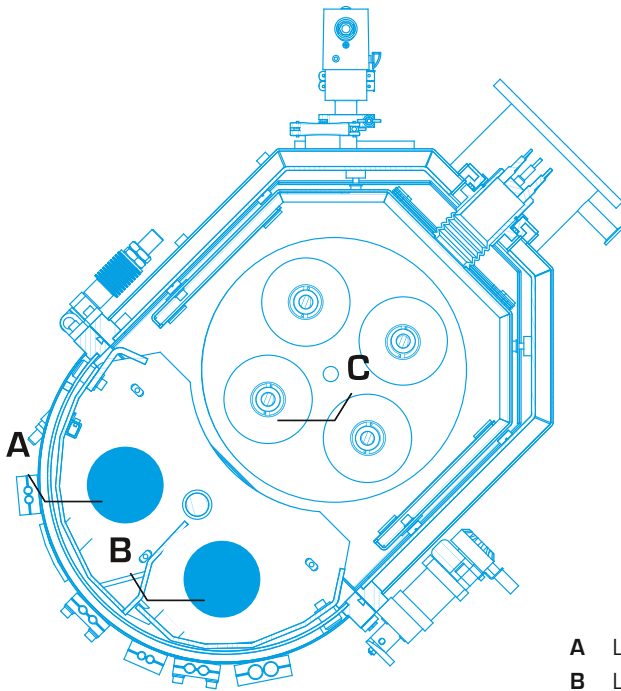


PLATIT® 11 - Series

# 111 Smart Speed Unit



## ARC TECHNOLOGY – 2 ROTATING CATHODES



- A LARC® PLUS Cathode
- B LARC® PLUS Cathode
- C Carousel



The Pi111 PLUS G3 represents the third generation of a compact PVD coating unit from PLATIT. Its key features are fast cycle times, easy operation and user-friendliness at a favorable price – without compromising coating performance. Having two rotating cathodes utilizing ARC technology, the unit deposits selected PLATIT Signature Coatings at a consistently high level of quality. It is the ideal choice for customers looking to enter the coating world or wanting to add a fast low-volume PVD system to their fleet of machines.

OVERVIEW







**Technologies applied:**  
 2 x LARC® PLUS (Lateral Rotating PLUS Cathode) for ARC deposition

**Advantages of LARC® PLUS compared to LARC®:**

- Improved target utilization (up to 30 %)
- Enhanced magnetic-field system, thus increased deposition rate
- Quick cathode exchange

FLATITE®



- |   |   |  |   |   |   |
|---|---|--|---|---|---|
| <b>Targets</b><br>2   | <b>Signature Coatings</b>   | <b>Cycle</b><br>≥ 4.5 h  | <b>Max. Load</b><br>160 kg  | <b>Solution</b><br>Turnkey  | <b>Service</b><br>Worldwide   |
|  |  |  |  |  |  |

## SPECIFICATIONS

### Etching technologies applied:

- LGD® (Lateral Glow Discharge)
- Plasma etching with argon, glow discharge
- Metal ion etching (Ti, Cr)

### Load and cycle times:

- Max. coating volume:  $\varnothing$  353 x H 498 [mm]
- Max. coating height with defined coating thickness: 414 mm
- Max. load: 160 kg

### 4 - 5 batches/day for\*:

Shank tools (2 $\mu$ m):	$\varnothing$ 10 x 70 [mm]	288 pcs.	4.5 h
Inserts (3 $\mu$ m):	$\varnothing/\square$ 20/14 x 6 [mm]	1680 pcs.	5.5 h
Hobs (4 $\mu$ m):	$\varnothing$ 80 x 180 [mm]	8 pcs.	7 h
Hobs (4 $\mu$ m):	$\varnothing$ 75 x 180 [mm]	20 pcs.	7 h

\* Average cycle times for a typical coating mix in a production environment.

### Modular carousel systems:

- Dual-rotation kicker carousel or triple-rotation gearbox system

### Software:

- Simple use and maintenance
- PLATIT SmartSoftware (PC and PLC system)
- Modern control system with touch screen
- Data recording and real-time display of process parameters and flow
- Manual and automatic process control
- Remote diagnostics and maintenance

### Machine dimensions:

- Footprint: W 2000 x D 1550 x H 2250 [mm]



PLATIT COATING INTELLIGENCE

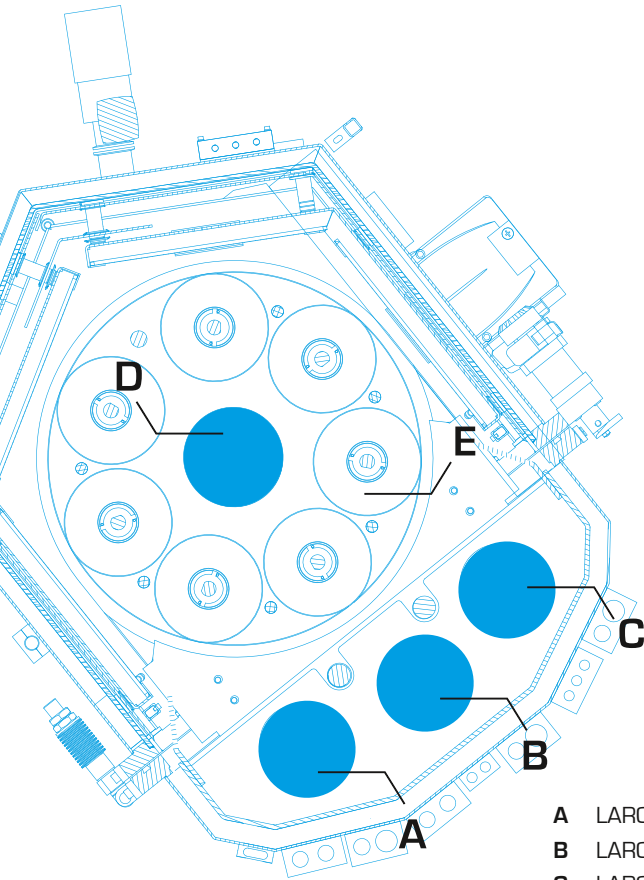
411

PLATIT® 11-Series

# 411 Ultra Flexible Unit



## THE CONCEPT OF THE ROTATING CENTRAL CATHODE



# 411 **ULTRA Flexible**

The broad variety of configuration options as well as the flexibility made possible by the rotating cathodes allows for the development of customer-specific top-performance coatings. Thus, this coating unit addresses the needs of customers who are seeking maximum flexibility with a full range of coating technologies easily accessible in one machine.

- A LARC® Cathode
- B LARC® Cathode
- C LARC® Cathode
- D CERC®/ SCIL® Cathode
- E Carousel



Due to its modular design and the range of available technologies, the Pi411 PLUS is the world's most flexible coating unit. Its basic configuration as an ARC unit with three rotating cathodes inside the door can be modularly upgraded on-site with an ARC or SPUTTER central cathode as well as with PECVD and OXI processes. Unique to this unit is also the availability of LACS® hybrid technology, which allows for the simultaneous deposition of coatings using both ARC and SPUTTER technology.

## CONFIGURATIONS



### Technologies applied:

- ECO:** Basic configuration with 3 x LARC® (Lateral Rotating Cathode) inside the door for ARC deposition
- PECVD (DLC2):** For a-C:H:Si coatings
- TURBO:** ECO + CERC® (Central Rotating Cathode) with ARC technology to increase productivity and allow for highly complex coatings
- OXI:** For oxide coatings in a corundum structure

- SCIL® (SPUTTERED Coating Induced by Lateral Glow Discharge):** High-performance SPUTTERING from the central cathode, e.g. for ta-C coatings
- Hybrid LACS®:** Simultaneous ARC and SPUTTER processes with LARC® inside the door and a central SCIL® cathode

PLATITE®

<b>Targets</b> 3 - 4	<b>Hybrid</b> LACS®	<b>Signature</b> Coatings	<b>Cycle</b> ≥ 4,5 h	<b>Max. Load</b> 200 kg	<b>Solution</b> Turnkey	<b>Service</b> Worldwide



# 411

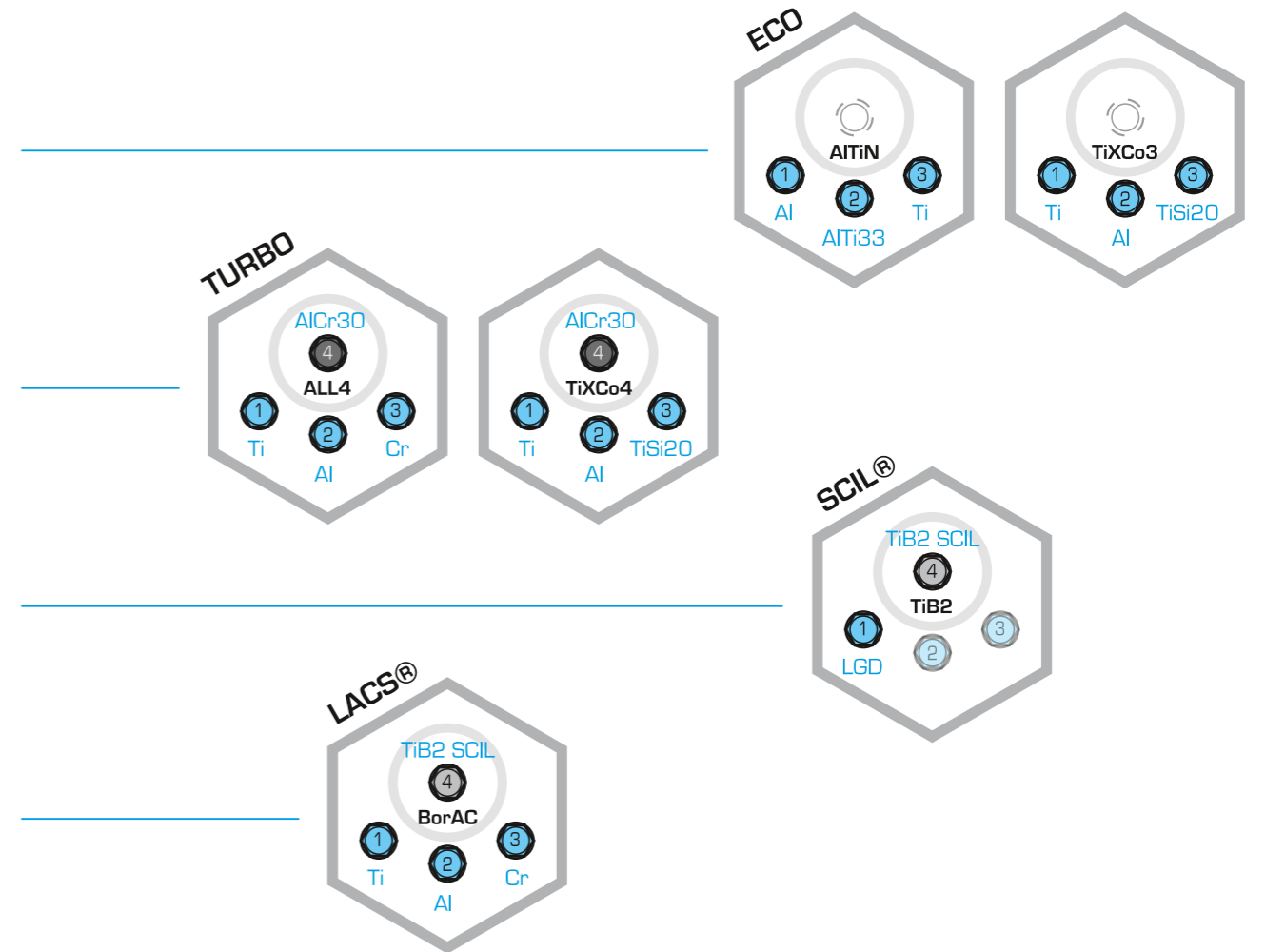
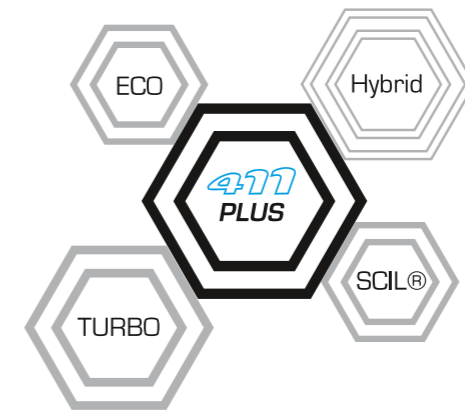


ECO

TURBO

SCIL®

HYBRID



**ULTRA**  
*Flexible*

## SPECIFICATIONS

### Etching technologies applied:

- LGD® (Lateral Glow Discharge)
- Plasma etching with argon, glow discharge
- Metal ion etching (Ti, Cr)

### Load and cycle times:

- Max. coating volume:  $\varnothing$  540 x H 500 [mm]
- Max. coating height with defined coating thickness: 414 mm
- Max. load: 200 kg

### Up to 5 batches/day for\*:

Shank tools (2 $\mu$ m):	$\varnothing$ 10 x 70 [mm]	504 pcs.	4.5 h
Inserts (3 $\mu$ m):	$\varnothing$ /□ 20/14 x 6 [mm]	2940 pcs.	5.5 h
Hobs (4 $\mu$ m):	$\varnothing$ 80 x 180 [mm]	28 pcs.	7 h

\* Average cycle times for a typical coating mix in a production environment.

### Modular carousel systems:

- 1 to 14 axes

### Software:

- Simple use and maintenance
- PLATIT SmartSoftware (PC and PLC system)
- Modern control system with touch screen
- Data recording and real-time display of process parameters and flow
- Manual and automatic process control
- Remote diagnostics and maintenance

### Machine dimensions:

- Footprint: W 2950 x D 1900 x H 2400 [mm]

# HiPIMS 3D Unit



PLATIT COATING INTELLIGENCE



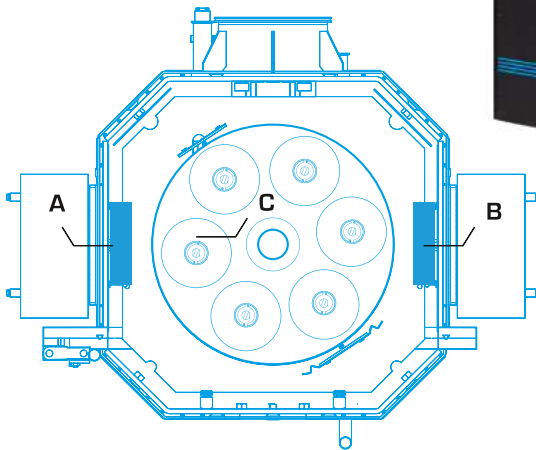
PLATIT® 11 - Series

# 711 HiPIMS 3D Unit



## OVERVIEW

- A Planar SPUTTER Cathode
- B Planar SPUTTER Cathode
- C Carousel



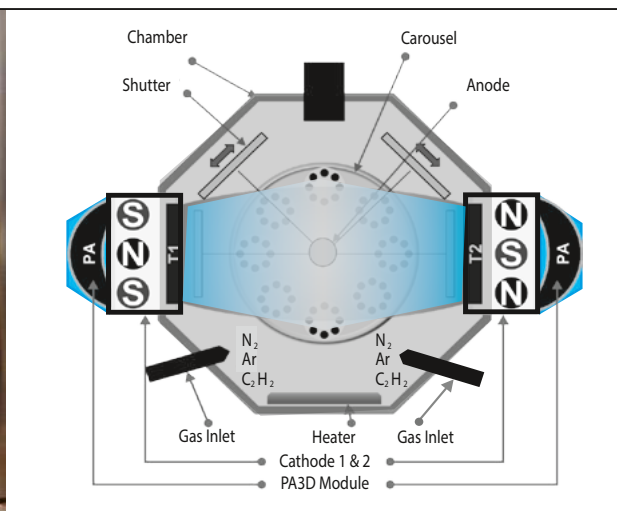
The PL711 is a compact SPUTTER coating unit based on HiPIMS technology (High Power Impulse Magnetron SPUTTERING). It's equipped with two Planar HiPIMS cathodes and allows for the deposition of selected nitride as well as carbon-based coatings (DLC1, DLC2, DLC3) using highly productive processes. Efficient plasma utilization is achieved through an additional booster, the PLATIT 3D module.

# ENHANCED PLASMA FOCUS

## PA3D Module

### Technologies applied:

- 2 x Planar SPUTTER cathode with HiPIMS technology
- The PA3D module (newly developed Helmholtz system) with a central anode focuses a dense, three-dimensional plasma with a high ionization degree in the carousel, generating homogeneous coatings and reaching a high deposition rate. Coatings from the PL711 provide outstandingly smooth surfaces with a high density, hardness and excellent adhesion.



**Targets**  
2



**Sputter**  
HiPIMS



**Signature**  
Coatings



**Cycle**  
≥ 6 h



**Max. Load**  
250 kg



**Solution**  
Turnkey



**Service**  
Worldwide



## SPECIFICATIONS

### Etching technologies applied:

- LGD® (Lateral Glow Discharge)
- Plasma etching with argon, glow discharge
- Metal ion etching (Ti, Cr)

### Deposition types:

SPUTTER nitride coatings

- Reactive and non-reactive processes
- Targets: Ti, Zr, Cr
- Coating temperature at 400°C or < 200°C in the low-temperature version

SPUTTER Cr and a-C:H:Si

- DLC2 (PECVD)
- Targets: Cr
- Coating temperature [°C]: 180 - 220

SPUTTER Cr and ta-C + a-C

- DLC3
- Targets: C, Cr
- Coating temperature [°C]: 180 - 250

### Load and cycle times:

- Max. coating volume: 4 x ø 225 x H 800 [mm]
- Max. coating height with defined coating thickness: 550 mm
- Max. load: 250 kg

### 2 batches/day for\*:

Shank tools (2 µm):	ø 10 x 55 [mm]	CrN	540 pcs.	11 h
Molds and dies (3 µm):	up to ø 225 x 140 [mm]	CrN	16 pcs.	10 h
Sliding parts (3 µm):	25 x 150 x 10 [mm]	DLC2	96 pcs.	8 - 9 h

\* Average cycle times for a typical coating mix in a production environment.

### Modular carousel systems:

- 1 or 3 or 6 axes

### Software:

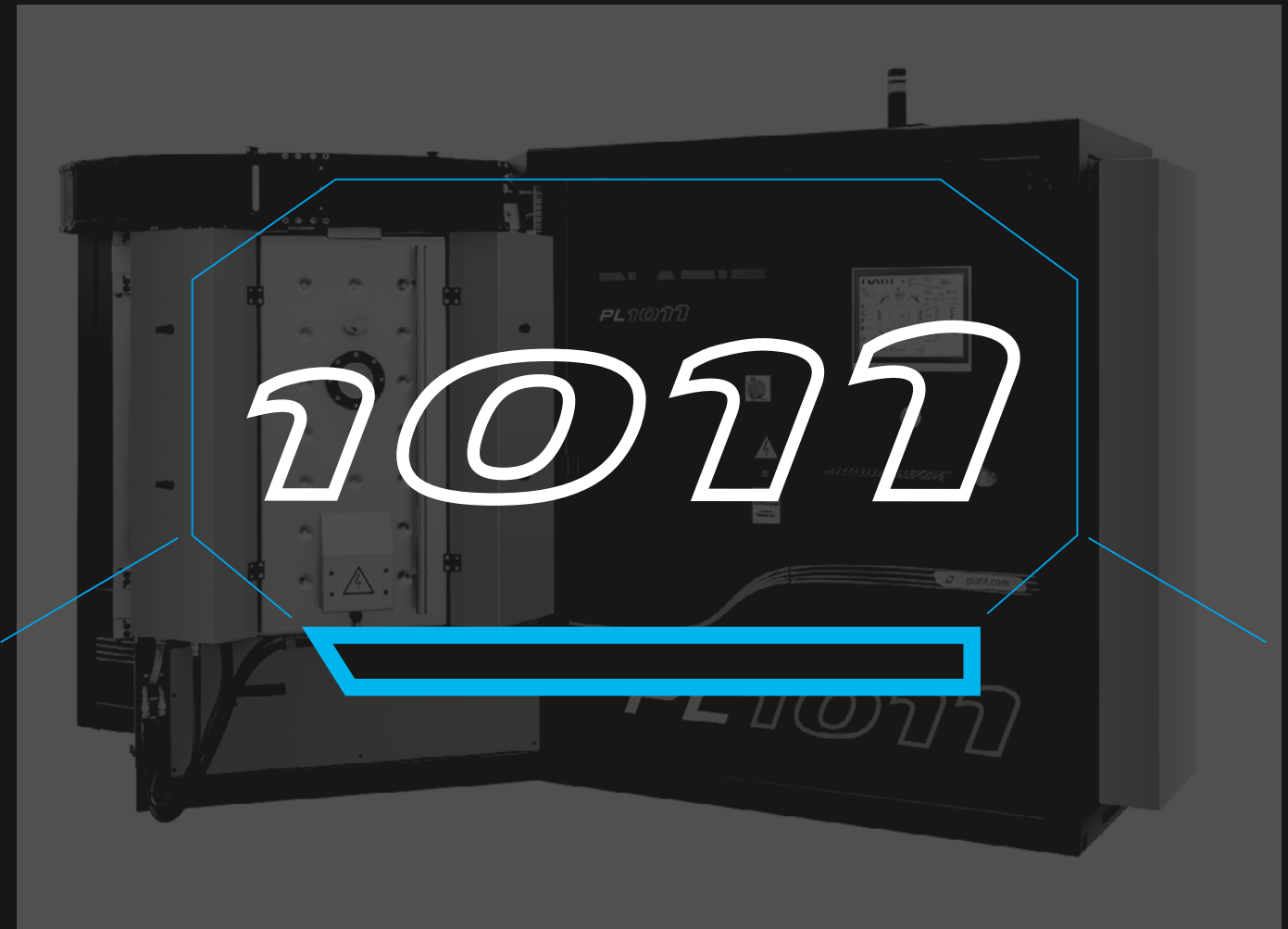
- Simple use and maintenance
- PLATIT SmartSoftware (PC and PLC system)
- Modern control system with touch screen
- Data recording and real-time display of process parameters and flow
- Manual and automatic process control
- Remote diagnostics and maintenance

### Machine dimensions:

- Footprint: W 3450 x D 2250 x H 2350 [mm]



PLATIT COATING INTELLIGENCE



PLATIT® 11 - Series

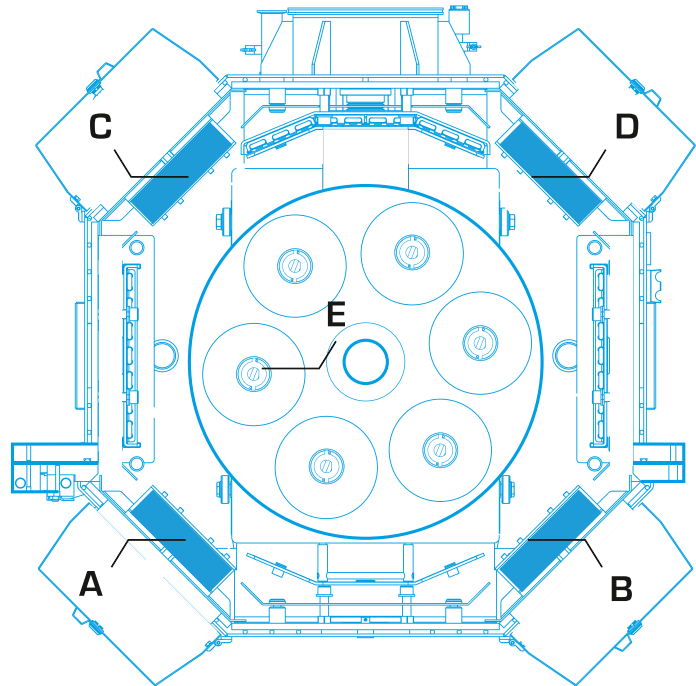
# 1011 High Volume Unit



MAXIMUM PRODUCTIVITY



The PL1011 is designed for customers who seek a mix of process reliability and high-quality coatings at a low cost per tool.



- A Planar Cathode
- B Planar Cathode
- C Planar Cathode
- D Planar Cathode
- E Carousel



The PL1011 is the backbone of every high-volume coating center. It has four Planar cathodes utilizing ARC technology and allows for the deposition of all PLATIT standard coatings at a consistently high level of quality and productivity. This coating unit combines maximum production availability with a user-friendly interface and maintenance concept.

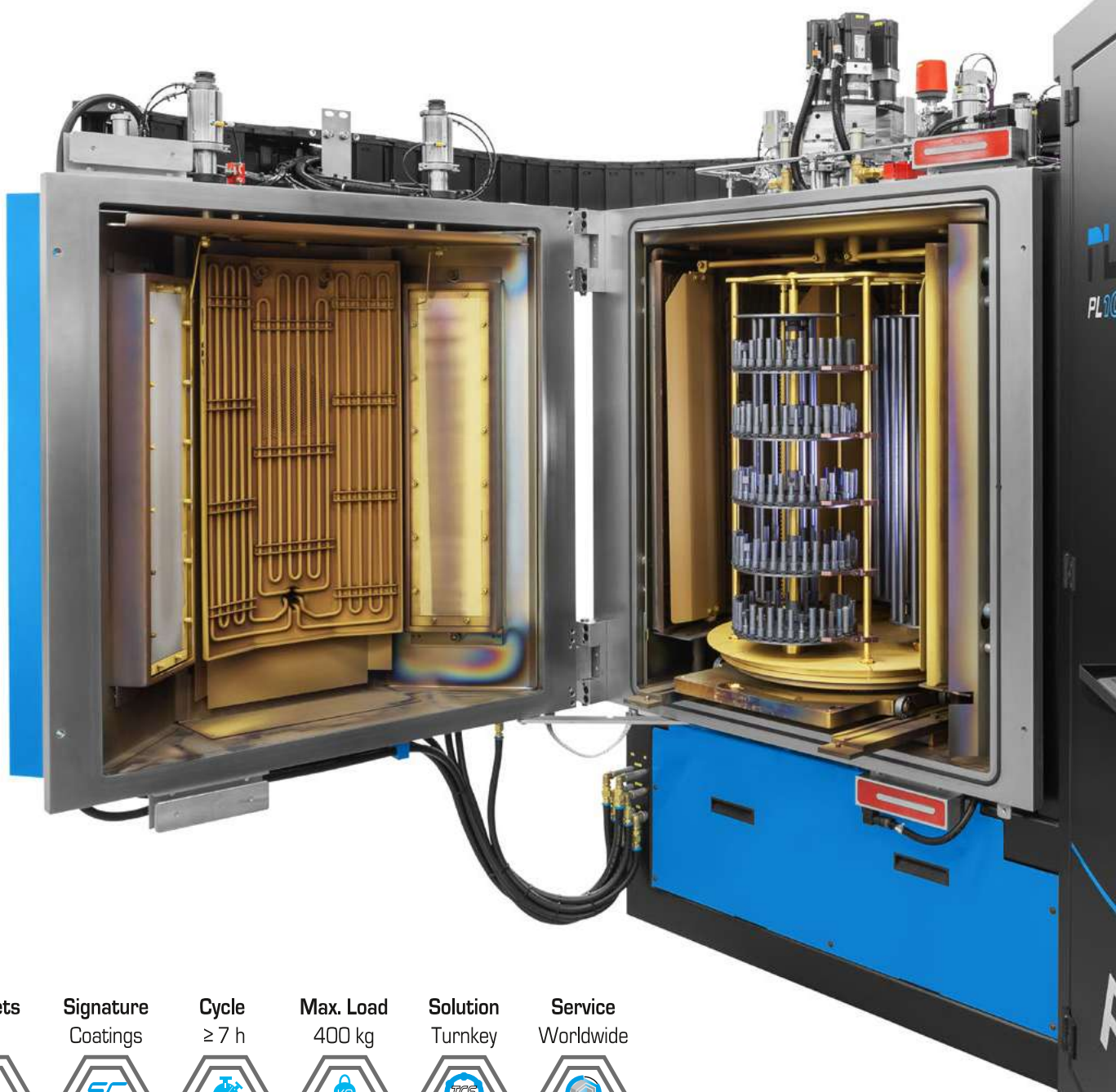


OVERVIEW

**Technologies applied:**

- 4 x Planar cathode using ARC technology for depositing

PLATITE®



**Targets**  
4



**Signature Coatings**



**Cycle**  
≥ 7 h



**Max. Load**  
400 kg



**Solution**  
Turnkey



**Service**  
Worldwide



## SPECIFICATIONS

### Etching technologies applied:

- LGD® (Lateral Glow Discharge)
- Plasma etching with argon, glow discharge
- Metal ion etching (Ti, Cr)

### Load and cycle times:

- Max. coating volume:  $\varnothing$  715 x H 805 [mm]
- Max. coating height with defined coating thickness: 711 mm
- Max. load: 400 kg

### 3 batches/day for \*:

Shank tools (2 $\mu$ m):	$\varnothing$ 10 x 70 [mm]	1008 pcs.	7 h
Inserts (3 $\mu$ m):	$\varnothing/\square$ 20/14 x 6 [mm]	8640 pcs.	7.5 h
Hobs (4 $\mu$ m):	$\varnothing$ 80 x 180 [mm]	48 pcs.	7.5 h

\* Average cycle times for a typical coating mix in a production environment.

### Modular carousel systems:

- 1 to 12 axes

### Software:

- Simple use and maintenance
- PLATIT SmartSoftware (PC and PLC system)
- Modern control system with touch screen
- Data recording and real-time display of process parameters and flow
- Manual and automatic process control
- Remote diagnostics and maintenance

### Machine dimensions:

- Footprint: W 4000 x D 2250 x H 2350 [mm]



PLATIT COATING INTELLIGENCE

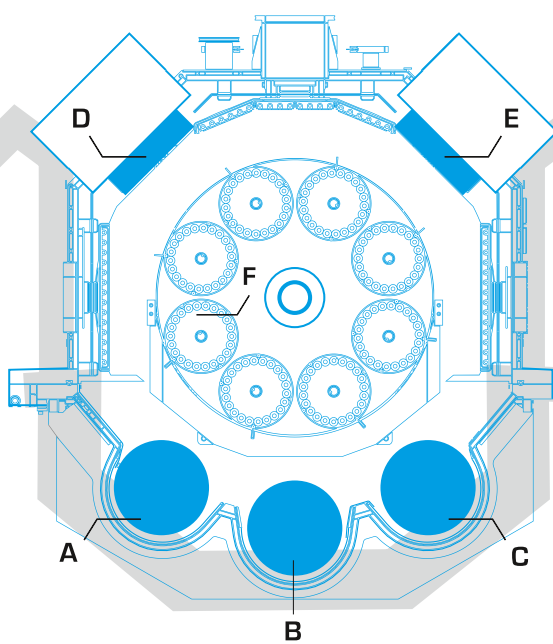
# 1511

PLATIT® 11 - Series

# 1511 Big Combo Unit



## PLANAR AND ROTATING CATHODES



- A LARC® XL Cathode
- B LARC® XL Cathode
- C LARC® XL Cathode
- D Planar Cathode
- E Planar Cathode
- F Carousel



The Pi1511 is a high-volume PVD coating unit. It combines three rotating PLATIT LARC® XL cathodes positioned inside the door with two Planar ARC cathodes in the back of the chamber. The combination of round cathodes with high-performing Planar cathodes allows for the deposition of PLATIT Signature Coatings with familiar flexibility. The LARC® XL cathodes have a very long lifespan and thus guarantee high productivity at a low cost per tool.

## OVERVIEW

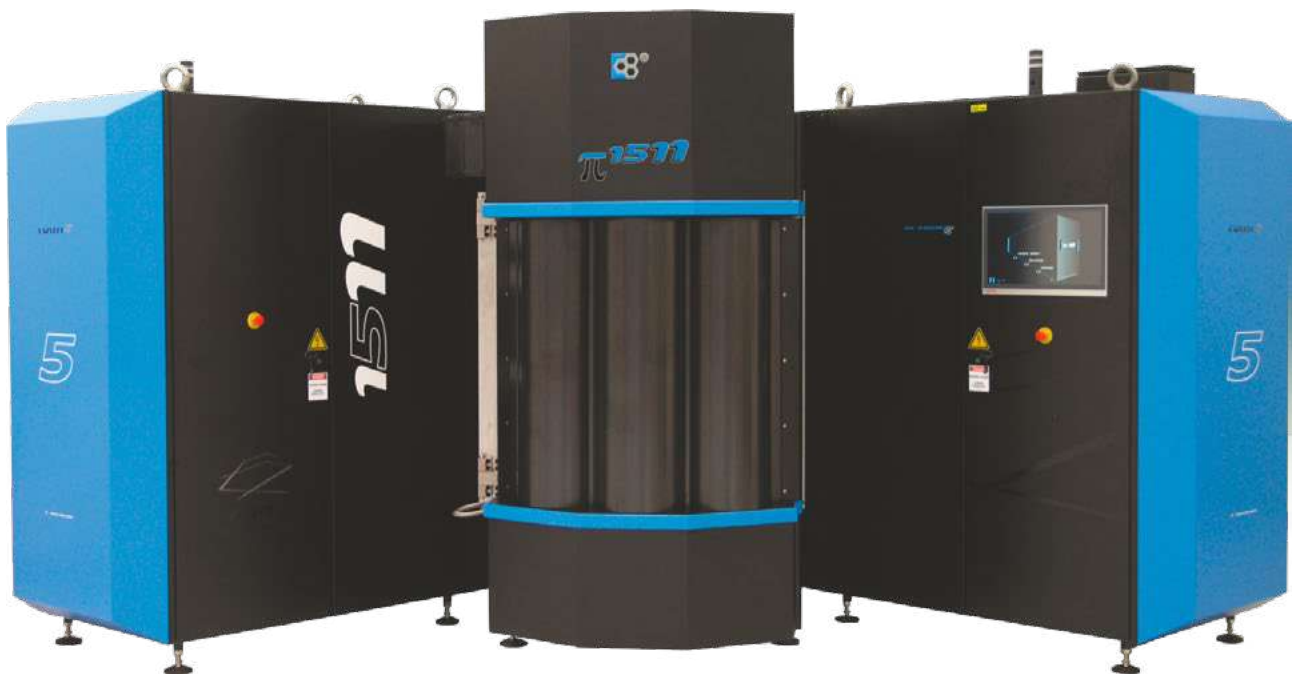
### Technologies applied:

- 3 x LARC® XL (Lateral Rotating XL Cathode) inside the door and 2 x Planar cathode with ARC technology in the back
- MAC-3C (Magnetic ARC Confinement - Coil Current Compensation) for automated magnetic field adjustment
- Quick cathode exchange
- Deposition of PLATIT® Signature Coatings



*Magnetic ARC Confinement -  
Coil Current Compensation*

PLATIT®



**Targets**  
2



**Targets**  
3



**Signature Coatings**



**Cycle**  
≥ 7 h



**Max. Load**  
400 kg



**Solution**  
Turnkey



**Service**  
Worldwide



## SPECIFICATIONS

### Etching technologies applied:

- LGD® (Lateral Glow Discharge)
- Plasma etching with argon, glow discharge
- Metal ion etching (Ti, Cr)

### Load and cycle times:

- Max. coating volume:  $\varnothing$  715 x H 805 [mm]
- Max. coating height with defined coating thickness: 711 mm
- Max. load: 400 kg

### 3 batches/day for\*:

Shank tools (2 $\mu$ m):	$\varnothing$ 10 x 70 [mm]	1080 pcs.	7 h
Inserts (3 $\mu$ m):	$\varnothing/\square$ 20/14 x 6 [mm]	7200 pcs.	7.5 h
Hobs (4 $\mu$ m):	$\varnothing$ 80 x 180 [mm]	48 pcs.	7.5 h

\* Average cycle times for a typical coating mix in a production environment.

### Modular carousel systems:

- 1 to 12 axes

### Software:

- Simple use and maintenance
- PLATIT SmartSoftware (PC and PLC system)
- Modern control system with touch screen
- Statistics and help function via user interface
- Data recording and real-time display of process parameters and flow
- Manual and automatic process control
- Remote diagnostics and maintenance

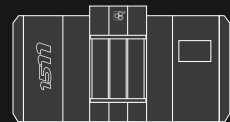
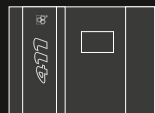
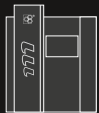
### Machine dimensions:

- Footprint: W 4900 x D 2200 x H 2450 [mm]



PLATIT COATING INTELLIGENCE

- CAROUSELS
- HOLDERS
- LOADING CAPACITIES



PLATIT® 11 - Series

PLATIT® 11 - Series

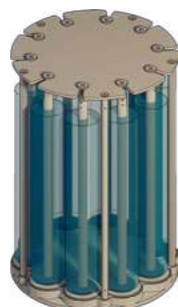
111



Single rotation  
D ≤ 355 mm



4 axes for continuous triple rotation for gearboxes  
D ≤ 143 mm

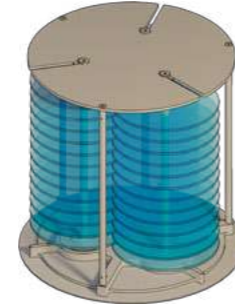


10 axes for continuous double rotation  
D ≤ 77 mm

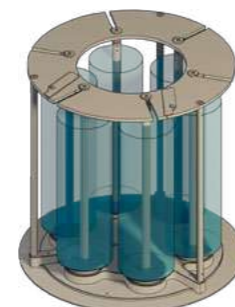
411



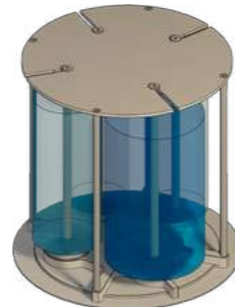
Single rotation  
D ≤ 500 mm for saw blades,  
D ≤ 460 mm for molds & dies



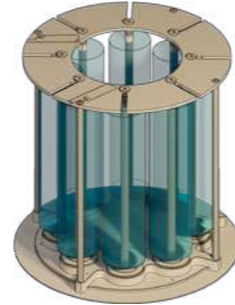
3 axes for saw blades with overlap  
D ≤ 285 mm



3 / 6 axes  
D3 ≤ 220 mm /  
D6 ≤ 150 mm



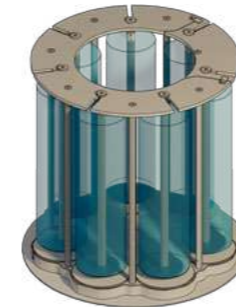
4 asymmetric axes  
D3 ≤ 183 mm,  
D1 ≤ 250 mm



4 / 8 axes  
D4 ≤ 215 mm /  
D8 ≤ 115 mm



5 / 10 axes  
D5 ≤ 175 mm /  
D10 ≤ 94 mm



7 axes for triple rotation for gearboxes  
D ≤ 143 mm

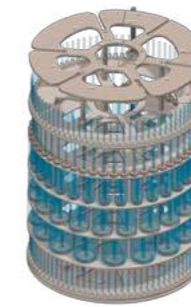


6 / 12 axes  
D6 ≤ 145 mm /  
D12 ≤ 100 mm

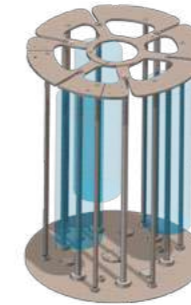


14 axes  
D ≤ 85 mm

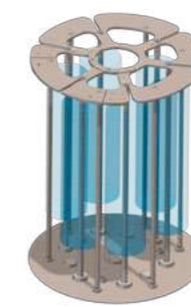
711



Double rotation  
D ≤ 600 mm



3 axes for kicker  
D ≤ 160 mm

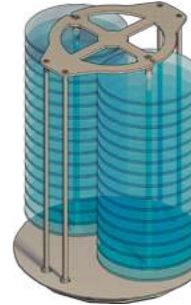


6 axes for kicker or gearboxes  
D ≤ 143 mm

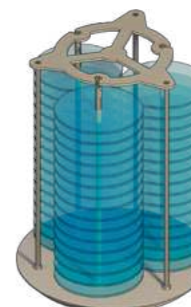
1011 / 1511



Single rotation  
D ≤ 700 mm



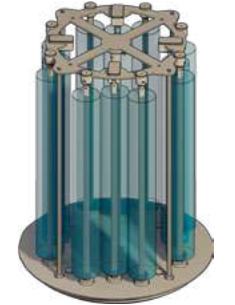
2 axes for saw blades with overlap  
D ≤ 450 mm



3 axes for saw blades with overlap,  
D ≤ 420 mm  
without overlap,  
D ≤ 250 mm



4 axes for kicker  
D ≤ 270 mm



4 / 8 / 12 axes for kicker  
D ≤ 170 mm



10 axes for gearboxes  
D ≤ 143 mm



## Design and operating principle



### Holder for shank tools

- Sleeves and revolvers for holding shank tools



### Disc with gears

- For sleeves
- Tools rotate stepwise, driven by kickers from the side



### Gearbox for triple rotation

- For sleeves
- Tools rotate continuously, centrally driven
- Gearbox simplifies the loading of batches considerably as no kicker adjustment is required



### Quad gearbox for quad rotation

- For optimal utilization of the available loading volume
- Suitable for shank tools  $\leq 8$  mm and single-origin loads
- Tools rotate stepwise, driven by kickers from the side



### Holder for deep drawing dies (rings)

- For holding deep drawing dies (rings)
- Tools rotate continuously



### Holder for hobs

- For holding hobs with and without shank
- Hobs rotate continuously

### Holder for inserts

- For holding inserts on rods
- Inserts rotate stepwise, driven by kickers from the side
- Loaded holder can be used for all process steps of a turnkey system



### Holder for molds and dies

- For holding molds and dies vertically or horizontally
- Vertical holder with slots allows for flexible clamping of the tools by screws or magnets



### Holder for saw blades

- For holding and separation of saw blades
- Saw blades rotate continuously



### Accessories

- For holding test pieces
- Dummy as a placeholder for empty gearbox positions
- Dummy cage as a placeholder for empty satellite positions



# Loading capacities



## OVERVIEW

Coating unit	Tool type	Tool diameter	Tool length	Satellites	Discs/satellite	Holders/disc	Tools/holder	Tools/disc	Tools/batch
Pi111	Shank tool	6 mm	50 mm	4	4	5	9	45	720
		6 mm	50 mm	4	5	8	4	32	640
		6 mm	50 mm	4	5	18	1	18	360
		8 mm	60 mm	4	4	18	1	18	288
		10 mm	70 mm	4	4	18	1	18	288
		20 mm	100 mm	4	3	12	1	12	144
	Insert	20 mm	6 mm	4	1	15	28	420	1680
	Hob	80 mm	120 mm	4	3	1	1	1	12
		80 mm	180 mm	4	2	1	1	1	8
		75 mm	180 mm	10	2	1	1	1	20

Coating unit	Tool type	Tool diameter	Tool length	Satellites	Gearboxes/satellite	Holders/gearbox	Tools/holder	Tools/gearbox	Tools/batch
Pi411	Shank tool	6 mm	50 mm	7	4	5	9	45	1260
		6 mm	50 mm	7	5	8	4	32	1120
		6 mm	50 mm	7	5	18	1	18	630
		8 mm	60 mm	7	4	18	1	18	504
		10 mm	70 mm	7	4	18	1	18	504
		20 mm	100 mm	7	3	12	1	12	252
	Insert	20 mm	6 mm	7	1	15	28	420	2940
	Hob	80 mm	120 mm	14	3	1	1	1	42
		80 mm	180 mm	14	2	1	1	1	28

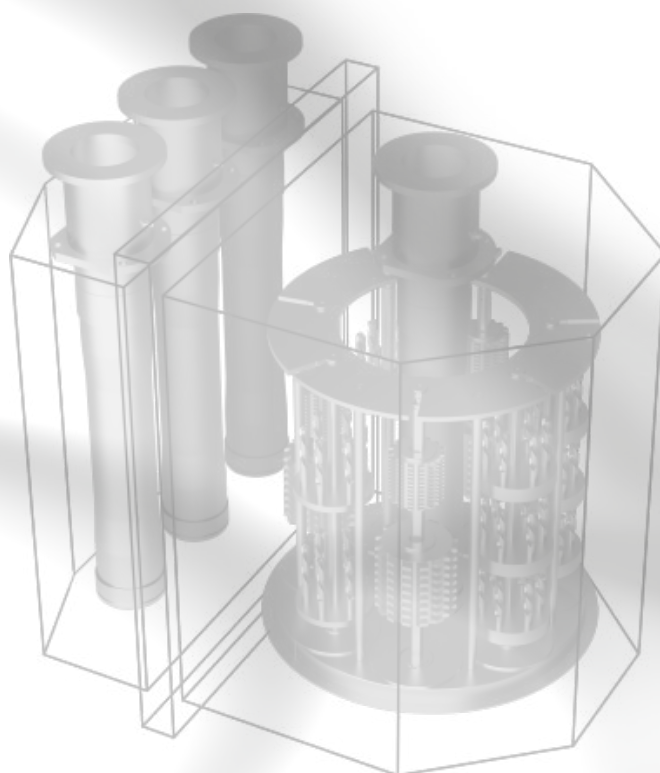
Coating unit	Tool type	Tool diameter	Tool length	Satellites	Gearboxes/satellite	Holders/gearbox	Tools/holder	Tools/gearbox	Tools/batch
PL711	Shank tool	6 mm	50 mm	6	6	8	4	32	1152
		6 mm	50 mm	6	6	18	1	18	648
		8 mm	60 mm	6	6	18	1	18	648
		10 mm	70 mm	6	5	18	1	18	540
		20 mm	100 mm	6	4	12	1	12	288
	Insert	20 mm	6 mm	6	1	15	22	330	1980
	Molds & dies	150 mm	150 mm	4	4	1	1	1	16
	Sliding parts with DLC2	25 x 10 mm	150 mm	4	6	4	1	1	96

Coating unit	Tool type	Tool diameter	Tool length	Satellites	Discs/satellite	Holders/disc	Tools/holder	Tools/disc	Tools/batch
PL1011	Shank tool	6 mm	50 mm	4	8	23	4	92	2944
		6 mm	50 mm	4	8	42	1	18	1344
		8 mm	60 mm	4	7	42	1	42	1176
		10 mm	70 mm	4	6	42	1	42	1008
		20 mm	100 mm	4	4	36	1	36	576
	Insert	20 mm	6 mm	4	2	36	30	1080	8640
	Hob	80 mm	120 mm	12	6	1	1	1	72
		80 mm	180 mm	12	4	1	1	1	48

Coating unit	Tool type	Tool diameter	Tool length	Satellites	Gearboxes/satellite	Holders/gearbox	Tools/holder	Tools/gearbox	Tools/batch
Pi1511	Shank tool	6 mm	50 mm	10	7	5	9	45	3150
		6 mm	50 mm	10	8	8	4	32	2560
		6 mm	50 mm	10	8	18	1	18	1440
		8 mm	60 mm	10	7	18	1	18	1260
		10 mm	70 mm	10	6	18	1	18	1080
		20 mm	100 mm	10	5	12	1	12	600
	Insert	20 mm	6 mm	10	2	12	30	360	7200
	Hob	80 mm	120 mm	12	6	1	1	1	72
		80 mm	180 mm	12	4	1	1	1	48

### Legend

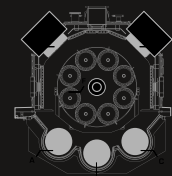
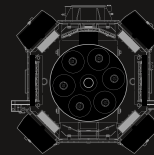
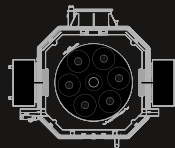
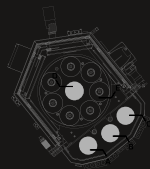
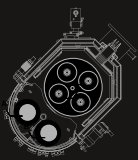
Tool in a sleeve, driven by a gearbox	Tool in a revolver, driven by a gearbox	Tool in a sleeve, driven by a quad gearbox
Tool in a sleeve, driven by a kicker	Tool in a revolver, driven by a kicker	
Insert with a hole, speared on a rod	Hob on a satellite	





## PLATIT COATING INTELLIGENCE

### CATHODE CONFIGURATIONS



# Cathode configurations

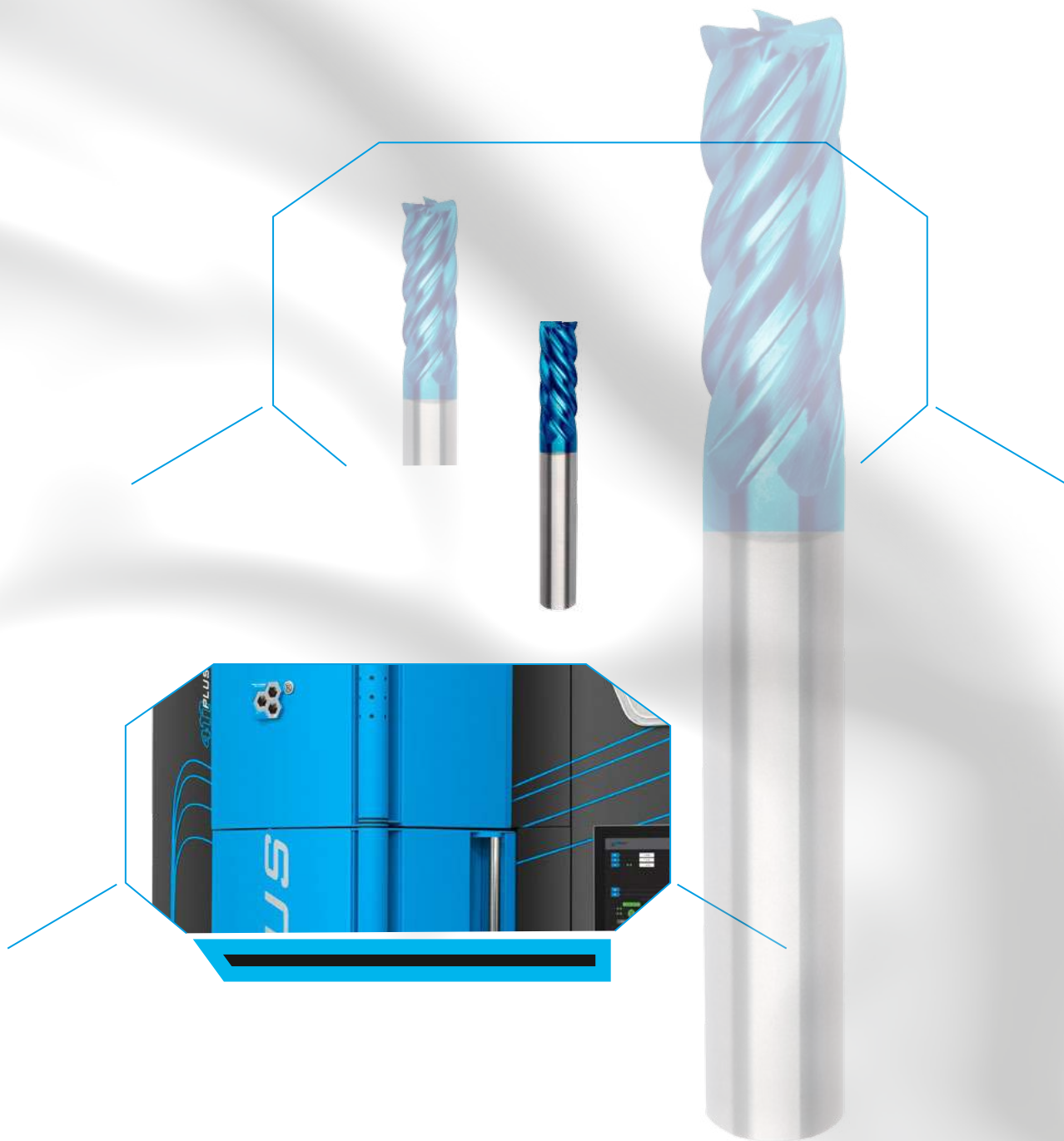


## STANDARD CONFIGURATIONS AND AVAILABLE UPGRADES

PLATIT® <i>11</i> - Series		111	411		711	1011	1511	
Standard configurations		2 x LARC® PLUS	3 x LARC®, additional options available		2 x Planar HiPIMS & PECVD mode	4 x Planar ARC	3 x LARC® XL & 2 x Planar ARC	
1	TiN	{-, Ti}	{Ti, -, -} (LGD, -, -, Ti SCIL)		{Cr, Ti}	{Ti, -, Ti, -}	{Ti, Al, TiSi20, Ti, AlTi33}	1
2	TiCN		{Ti, -, -}			{Ti, -, Ti, -}		2
3	TiAlN	{Al, Ti}	{Al, AlTi33, Ti} {Ti, Al, -} {Ti, Al, -, AlTi33}			{Ti, TiAl50, Ti, TiAl50}		3
4	TiAlCN		{Ti, Al, -} {Ti, Al, Ti, AlTi33}			{Ti, TiAl50, Ti, TiAl50}		4
5	AlTiN	{Al, Ti}	{Al, AlTi33, Ti} {Ti, Al, -} {Ti, Al, -, AlTi33}			{Ti, AlTi33, Ti, AlTi33}	{Ti, Al, -, Ti, AlTi33}	5
6	CrN	{-, Cr}	{Cr, -, -}		{Cr, Cr}	{-, Cr, -, Cr}		6
7	CrTiN	{Cr, Ti}	{Ti, -, Cr} {Ti, Al, -, CrTi50 SCIL}			{Ti, Cr, Ti, Cr}		7
8	ZrN	{Zr, Ti}	{Ti, -, Zr}			{Ti, Zr, Ti, Zr}		8
9	AlCrN	{Al, Cr}	{Al, AlCr30, Cr} {-, Al, Cr} {-, Al, Cr, AlCr30} (LGD, -, Cr, AlCr30 SCIL)			{Cr, AlCr35, -, AlCr35}	{Ti, Al, Cr, AlCr36, AlCr36}	9
10	AlTiCrN	{AlCr30, Ti}	{Ti, Al, Cr}			{Cr, AlTi33, AlTi33, AlCr36}		10
11	ALL4	{Al, CrTi15}	{CrTi15, Al, Cr} {Ti, Al, Cr, AlCr30}			{Cr, AlTi33, Cr, AlTi33}		11
12	nACo	{AlSi12, Ti}	{Ti, AlSi18, -} {Ti, AlSi18, -, AlTi33}			{Ti, AlTi33, AlTi33-10, AlTi33}	{Ti, Al, TiSi20, AlTi33, AlTi33}	12
13	nACRo	{AlSi12, Cr}	{-, AlSi18, Cr} {-, AlSi18, Cr, AlTi33}			{Cr, AlCrSi30-10, Cr, AlCr36}	{-, AlSi18, Cr, AlCr36, AlCr36}	13
14	TiXCo3	{Al, TiSi20}	{Ti, Al, TiSi20}			{Ti, AlTi33, TiSi20, AlTi33}	{Ti, Al, TiSi20, AlTi33, AlTi33}	14
15	TiXCo4		{Ti, Al, TiSi20, AlCr30}					15
16	PSiX		{Ti, Al, TiSi20}					16
17	BorAC		{Al, AlCrB20-10, Cr} {Ti, Al, Cr, TiB2 SCIL}					17
18	BorAX		{TiSi20, Al, Cr, TiB2 SCIL}					18
19	TiB2		(LGD, -, -, TiB2 SCIL)					19
20	WC/C		(LGD, -, Cr, W SCIL)					20
21	DLC1: TiCN + a-C:H:Me		{Ti, -, -}			{Ti, -, Ti, -}		21
22	DLC1: nACRo + a-C:H:Me		{-, AlSi18, Cr}					22
23	DLC2: TiN + a-C:H:Si		(LGD, -, -, Ti SCIL)					23
24	DLC2: CrN + a-C:H:Si		{-, -, Cr}		{Cr, Cr}			24
25	DLC2: CrTiN + a-C:H:Si		{Ti, -, Cr}					25
26	DLC3: Cr + ta-C/a-C		(LGD, -, Cr, C SCIL)		{Cr, C}			26
27	nACoX		{Ti, AlSi18, AlCr45}					27

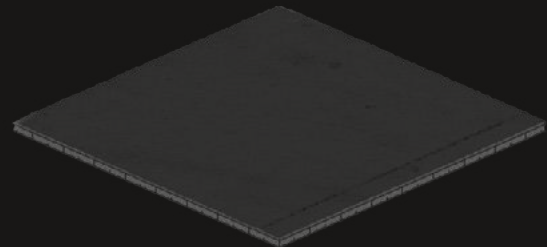
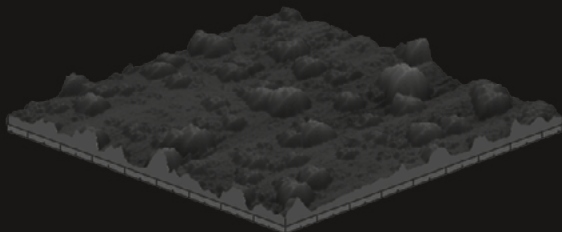
### Legend

Standard configuration	Available with TURBO configuration	Available with LACS® configuration
Available with PECVD option (DLC2)	Available with SCIL® configuration	Available with OXI configuration



## PLATIT COATING INTELLIGENCE

- COATING GUIDE
- COATING PROPERTIES
- SIGNATURE COATINGS



PLATIT® *11* - Series

## CUTTING

WORKPIECE MATERIAL			Turning			Milling				Gear cutting				Sawing		Drilling		Deep hole drilling	Reaming	Broaching	Tapping	
			Inserts			Inserts	Shank tools	Micro tools	Hobs	Pinion cutting	Skiving	Fly cutters, stick blades	Saw blades	Band saws	Drilling	Micro tools	Taps, thread cutters				Tap forming, thread forming	
1 Steels unalloyed < 1000 N/mm <sup>2</sup>	Dry	A B	nACo AlTiN	ALL4 BorAC	ALL4 BorAC	AlCrN --	ALL4 BorAC	ALL4 BorAC	ALL4 AlCrN	TiXCo4 AlTiCrN		AlTiCrN AlTiN	nACo TiAlCN	AlTiN TiXCo3	AlTiN TiXCo3	AlTiN TiXCo3	nACo TiXCo3	TiN TiCN	TiN TiCN	TiCN CrTiN		
	Wet	A B	nACo AlTiN	AlTiCrN ALL4	AlTiCrN ALL4	AlCrN --	AlTiCrN ALL4	AlTiCrN ALL4	AlTiCrN ALL4	TiXCo4 AlTiCrN		AlTiCrN AlTiN	nACo TiAlCN	AlTiN TiXCo3	AlTiN TiXCo3	AlTiN TiXCo3	nACo TiXCo3	TiN TiCN	TiN TiCN	TiCN CrTiN		
2 Steels unalloyed > 1000 N/mm <sup>2</sup>	Dry	A B	nACo AlTiN	ALL4 BorAC	ALL4 BorAC	AlCrN --	ALL4 BorAC	ALL4 AlCrN	ALL4 AlCrN	TiXCo4 AlTiCrN		AlTiCrN AlTiN	nACo TiAlCN	AlTiN TiXCo3	AlTiN TiXCo3	AlTiN TiXCo3	nACo TiXCo3	AlTiN TiCN	TiN TiCN	TiCN CrTiN		
	Wet	A B	nACo AlTiN	AlTiCrN ALL4	AlTiCrN ALL4	AlCrN --	AlTiCrN ALL4	AlTiCrN ALL4	AlTiCrN ALL4	TiXCo4 AlTiCrN		AlTiCrN AlTiN	nACo TiAlCN	AlTiN TiXCo3	AlTiN TiXCo3	AlTiN TiXCo3	nACo TiXCo3	AlTiN TiCN	TiN TiCN	TiCN CrTiN		
3 Steels hardened < 55 HRC	Dry	A B	TiXCo4 nACo	TiXCo4 nACo	TiXCo4 nACo	TiXCo3 --	-- --	TiXCo4 ALL4	-- --			nACo AlTiN	nACo AlTiN	TiXCo3 nACo	TiXCo3 nACo	-- --	nACo TiXCo3	-- --	-- --	-- --		
	Wet	A B	TiXCo4 nACo	TiXCo4 nACo	TiXCo4 nACo	TiXCo3 --	-- --	TiXCo4 ALL4	-- --			nACo AlTiN	nACo AlTiN	TiXCo3 nACo	TiXCo3 nACo	-- --	nACo TiXCo3	-- --	-- --	-- --		
4 Steels hardened > 55 HRC	Dry	A B	TiXCo3 PSiX	TiXCo3 PSiX	TiXCo3 PSiX	TiXCo3 --	-- --	TiXCo4 BorAX	-- --			-- --	-- --	TiXCo3 --	TiXCo3 --	-- --	-- --	-- --	-- --	-- --		
	Wet	A B	PSiX nACo	PSiX nACo	PSiX nACo	TiXCo3 --	-- --	TiXCo4 BorAX	-- --			-- --	-- --	-- --	-- --	-- --	-- --	-- --	-- --	-- --	-- --	
5 Stainless steel	Dry	A B	nACo AlTiN	nACo AlTiN	nACo AlTiN	nACo --	-- --	-- --	-- --			AlTiN TiAlCN	nACo TiAlCN	AlTiN TiXCo3	AlTiN TiXCo3	AlTiN TiXCo3	nACo TiXCo3	-- --	TiN TiCN	TiCN CrTiN		
	Wet	A B	PSiX AlTiN	PSiX AlTiN	PSiX AlTiN	nACo --	-- --	-- --	-- --			AlTiN TiAlCN	nACo TiAlCN	AlTiN TiXCo3	AlTiN TiXCo3	AlTiN TiXCo3	nACo TiXCo3	-- --	TiN TiCN	TiCN CrTiN		
6 Stainless steel > 45 HRC	Dry	A B	TiXCo3 nACo	TiXCo3 PSiX	TiXCo3 PSiX	TiXCo3 --	-- --	-- --	-- --			-- --	-- --	AlTiN TiXCo3	AlTiN TiXCo3	AlTiN TiXCo3	nACo TiXCo3	-- --	TiN TiCN	-- --		
	Wet	A B	TiXCo3 TiAlCN	TiXCo3 PSiX	TiXCo3 PSiX	TiXCo3 --	-- --	-- --	-- --			-- --	-- --	AlTiN TiXCo3	AlTiN TiXCo3	AlTiN TiXCo3	nACo TiXCo3	-- --	TiN TiCN	-- --		
7 Superalloys Ni-based	Dry	A B	nACoX AlTiN	nACoX ALL4	BorAX ALL4	TiXCo3 --	-- --	-- --	-- --			AlTiCrN AlTiN	AlTiCrN AlTiN	TiXCo4 nACoX	-- --	-- --	-- --	-- --	TiCN TiAlCN	-- --		
	Wet	A B	nACoX AlTiN	nACoX ALL4	BorAX ALL4	TiXCo3 --	-- --	-- --	-- --			AlTiCrN AlTiN	AlTiCrN AlTiN	TiXCo4 nACoX	-- --	-- --	-- --	-- --	TiCN TiAlCN	-- --		
8 Superalloys Ti-based	Dry	A B	nACo --	nACo nACRo	nACo nACRo	nACo nACRo	-- --	-- --	-- --			AlTiCrN AlTiN	AlTiCrN AlTiN	TiXCo3 AlTiN	-- --	-- --	-- --	-- --	TiCN TiAlCN	-- --		
	Wet	A B	nACo --	nACo nACRo	nACo nACRo	nACo nACRo	-- --	-- --	-- --			AlTiCrN AlTiN	AlTiCrN AlTiN	TiXCo3 AlTiN	-- --	-- --	-- --	-- --	TiCN TiAlCN	-- --		

A primary recommendation  
B secondary recommendation



## CONTINUATION OF CUTTING

WORKPIECE MATERIAL			Turning			Milling				Gear cutting				Sawing		Drilling		Deep hole drilling	Reaming	Broaching	Tapping		
			Inserts			Inserts	Shank tools	Micro tools	Hobs	Pinion cutting	Skiving	Fly cutters, stick blades	Saw blades	Band saws	Drilling	Micro tools	Taps, thread cutters				Tap forming, thread forming		
9 Cast iron	Dry	A B	nACo AlTiN	nACo AlTiN	nACo AlTiN	nACo	--	--	--	--	--	--	--	--	TiXCo3 nACo	--	--	TiXCo3 nACo	--	--	TiCN TiAlCN	--	
	Wet	A B	nACo AlTiN	nACo AlTiN	nACo AlTiN	nACo	--	--	--	--	--	--	--	--	TiXCo3 nACo	--	TiN TiCN	TiXCo3 nACo	--	--	TiCN TiAlCN	--	
10 Aluminum Si > 12%	Dry	A B	nACRo TiB2	nACRo TiB2	nACRo TiB2	nACRo TiB2	--	--	--	--	--	--	--	nACRo ALL4	nACRo ALL4	nACRo TiB2	nACRo TiB2	--	--	--	--	TiCN TiAlCN	--
	Wet	A B	nACRo TiB2	nACRo TiB2	nACRo TiB2	nACRo TiB2	--	--	--	--	--	--	--	nACRo ALL4	nACRo ALL4	nACRo TiB2	nACRo TiB2	--	--	--	--	TiCN TiAlCN	--
11 Aluminum Si < 12%	Dry	A B	DLC3: Cr + taC/aC TiB2	DLC3: Cr + taC/aC TiB2	DLC3: Cr + taC/aC TiB2	DLC3: Cr + taC/aC TiB2	--	--	--	--	--	--	--	DLC3: Cr + taC/aC ZrN	ZrN	TiB2 ZrN	TiB2 ZrN	--	--	--	--	TiCN TiB2	TiN ZrN
	Wet	A B	DLC3: Cr + taC/aC TiB2	DLC3: Cr + taC/aC TiB2	DLC3: Cr + taC/aC TiB2	DLC3: Cr + taC/aC TiB2	--	--	--	--	--	--	--	DLC3: Cr + taC/aC ZrN	ZrN	TiB2 ZrN	TiB2 ZrN	--	--	--	--	TiCN TiB2	TiN ZrN
12 Copper	Dry	A B	CrN DLC2: CrN + aCHSi	CrN DLC2: CrN + aCHSi	CrN DLC2: CrN + aCHSi	CrN DLC2: CrN + aCHSi	--	--	--	--	--	--	--	CrN	CrN	TiAlCN CrN	--	--	TiXCo3 nACo	--	--	TiCN TiAlCN	TiN ZrN
	Wet	A B	CrN DLC2: CrN + aCHSi	CrN DLC2: CrN + aCHSi	CrN DLC2: CrN + aCHSi	CrN DLC2: CrN + aCHSi	--	--	--	--	--	--	--	CrN	CrN	TiAlCN CrN	--	--	TiXCo3 nACo	--	--	TiCN TiAlCN	TiN ZrN
13 Bronze, brass	Dry	A B	CrN DLC2: CrN + aCHSi	CrN DLC2: CrN + aCHSi	CrN DLC2: CrN + aCHSi	CrN DLC2: CrN + aCHSi	--	--	--	--	--	--	--	CrN	CrN	TiAlCN CrN	--	--	TiXCo3 nACo	--	--	TiCN TiAlCN	TiN ZrN
	Wet	A B	CrN DLC2: CrN + aCHSi	CrN DLC2: CrN + aCHSi	CrN DLC2: CrN + aCHSi	CrN DLC2: CrN + aCHSi	--	--	--	--	--	--	--	CrN	CrN	TiAlCN CrN	--	--	TiXCo3 nACo	--	--	TiCN TiAlCN	TiN ZrN
14 Plastic	Dry	A B	--	--	DLC3: Cr + taC/aC TiB2	--	--	--	--	--	--	--	--	--	--	TiXCo3 DLC2: CrN + aCHSi	--	--	--	--	--	--	--
	Wet	A B	--	--	DLC3: Cr + taC/aC TiB2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
15 Graphite	Dry	A B	DLC3: Cr + taC/aC --	DLC3: Cr + taC/aC --	DLC3: Cr + taC/aC --	DLC3: Cr + taC/aC --	--	--	--	--	--	--	--	--	--	DLC3: Cr + taC/aC BorAX	DLC3: Cr + taC/aC BorAX	--	--	--	--	--	--
	Wet	A B	TiXCo4 DLC3: Cr + taC/aC	TiXCo4 DLC3: Cr + taC/aC	TiXCo4 DLC3: Cr + taC/aC	TiXCo3 DLC3: Cr + taC/aC	--	--	--	--	--	--	--	--	--	BorAX DLC3: Cr + taC/aC	BorAX DLC3: Cr + taC/aC	--	--	--	--	--	--
16 Carbon fiber reinforced polymer	Dry	A B	--	--	DLC3: Cr + taC/aC TiXCo4	DLC3: Cr + taC/aC TiXCo3	--	--	--	--	--	--	--	DLC3: Cr + taC/aC --	--	DLC3: Cr + taC/aC TiXCo3	DLC3: Cr + taC/aC TiXCo3	--	--	--	--	--	--
	Wet	A B	--	--	DLC3: Cr + taC/aC TiXCo4	DLC3: Cr + taC/aC TiXCo3	--	--	--	--	--	--	--	DLC3: Cr + taC/aC --	--	TiXCo3 DLC3: Cr + taC/aC	TiXCo3 DLC3: Cr + taC/aC	--	--	--	--	--	--
17 Wood	Dry	A B	--	DLC2: CrTiN + aCHSi CrN	DLC2: CrTiN + aCHSi CrN	--	--	--	--	--	--	--	--	DLC2: CrTiN + aCHSi CrN	--	DLC2: CrTiN + aCHSi TiXCo3	--	--	--	--	--	--	--
	Wet	A B	--	DLC2: CrTiN + aCHSi CrN	DLC2: CrTiN + aCHSi CrN	--	--	--	--	--	--	--	--	DLC2: CrTiN + aCHSi CrN	--	--	--	--	--	--	--	--	--

A primary recommendation / B secondary recommendation

# Coating guide



## CHIPLESS FORMING

TOOL MATERIAL		Fine blanking	Punching	Injection molding		Forming, embossing	Deep drawing	Extrusion
				Plastic	Aluminum			
HSS	A	AlCrN	AlCrN	--	--	CrN	ALL4	ALL4
	B	BorAC	ALL4	--	--	--	AlCrN	AlCrN
Carbide	A	AlCrN	AlCrN	--	--	--	--	--
	B	BorAC	ALL4	--	--	--	--	--
Steels unalloyed < 1000 N/mm <sup>2</sup>	A	--	--	CrN	AlTiCrN	--	--	--
	B	--	--	TiN	nACRo	--	--	--
Steels unalloyed > 1000 N/mm <sup>2</sup>	A	--	--	CrN	AlTiCrN	--	--	--
	B	--	--	TiN	nACRo	--	--	--
Steels hardened < 55 HRC	A	AlCrN	AlCrN	CrN	AlTiCrN	CrN	ALL4	ALL4
	B	BorAC	ALL4	TiN	nACRo	--	AlCrN	AlCrN
Steels hardened > 55 HRC	A	AlCrN	AlCrN	CrN	AlTiCrN	CrN	ALL4	ALL4
	B	BorAC	ALL4	TiN	nACRo	--	AlCrN	AlCrN
Aluminum Si > 12%	A	--	--	CrN	--	CrN	--	--
	B	--	--	TiN	--	TiN	--	--
Aluminum Si < 12%	A	--	--	--	--	CrN	--	--
	B	--	--	--	--	TiN	--	--
Copper	A	--	--	--	--	CrN	--	--
	B	--	--	--	--	TiN	--	--
Bronze, brass	A	--	--	--	--	CrN	--	--

A primary recommendation  
B secondary recommendation

## COMPONENTS

WORKPIECE MATERIAL		Machine parts <sup>1</sup>	Medical components			Tribology	Decorative materials
			Medical implants	Surgical, dental instruments	Anti-bacterial medical components		
Steels unalloyed < 1000 N/mm <sup>2</sup>	A	--	--	--	--	DLC2: CrN + a-C:H:Si	--
	B	--	--	--	--	DLC3: Cr + ta-C/a-C	--
Steels unalloyed > 1000 N/mm <sup>2</sup>	A	--	--	--	--	DLC2: CrN + a-C:H:Si	--
	B	--	--	--	--	DLC3: Cr + ta-C/a-C	--
Steels hardened < 55 HRC	A	CrTiN	--	--	--	DLC2: CrN + a-C:H:Si	--
	B	--	--	--	--	DLC3: Cr + ta-C/a-C	--
Steels hardened > 55 HRC	A	CrTiN	--	--	--	DLC2: CrN + a-C:H:Si	--
	B	--	--	--	--	DLC3: Cr + ta-C/a-C	--
Stainless steel	A	--	--	DLC2: CrN + a-C:H:Si	ZrN	DLC2: CrN + a-C:H:Si	Custom
	B	--	--	DLC3: Cr + ta-C/a-C	Cr2N	DLC3: Cr + ta-C/a-C	--
Stainless steel > 45 HRC	A	--	--	--	--	DLC2: CrN + a-C:H:Si	Custom
	B	--	--	--	--	DLC3: Cr + ta-C/a-C	--
Superalloys Ni-based	A	--	--	--	--	DLC2: CrN + a-C:H:Si	--
Superalloys Ti-based	A	--	Ti2N	DLC3: Cr + ta-C/a-C	--	DLC2: CrN + a-C:H:Si	--
	B	--	ZrN	DLC2: CrN + a-C:H:Si	--	--	--
Cast iron	A	CrN	--	--	--	--	--
Aluminum Si < 12%	A	CrN	--	--	--	--	--
Copper	A	--	--	--	ZrN	--	Custom
	B	--	--	--	Cr2N	--	--
Bronze, brass	A	--	--	--	ZrN	--	Custom
	B	--	--	--	Cr2N	--	--
Plastic	A	--	--	--	ZrN	--	Cr2N
	B	--	--	--	Cr2N	--	Custom

A primary recommendation

B secondary recommendation

<sup>1</sup> in abrasive and corrosive environment such as gears, water pumps, tool holders

# Coating properties



## OVERVIEW

	Color	Nano-hardness [GPa] by Fisher Nanoindentor	Coating thickness [ $\mu\text{m}$ ]	Coefficient of friction [ $\mu$ ] PoD [at RT, 50% humidity]	Max. service temperature [ $^{\circ}\text{C}$ ]
1 TiN	Gold	24 - 26	1 - 10	0.4	600
2 TiCN	Grey	36 - 38	1 - 3	0.25	450
3 TiAlN	Violet grey	36 - 38	1 - 5	0.5	700
4 TiAlCN	Red violet	34 - 36	1 - 5	0.25	450
5 AlTiN	Blue grey	36 - 38	1 - 5	0.6	900
6 CrN	Silver	21 - 23	1 - 10	0.5	700
7 CrTiN	Satin silver	28 - 30	1 - 10	0.4	700
8 ZrN	White gold	21 - 23	1 - 5	0.4	550
9 AlCrN	Grey	36 - 38	1 - 5	0.5	900
10 AlTiCrN	Grey	36 - 38	1 - 5	0.5	900
11 ALL4	Grey	36 - 38	1 - 5	0.5	900
12 nACo	Blue violet	39 - 41	1 - 4	0.4	1200
13 nACRo	Grey	39 - 41	1 - 4	0.5	1100
14 TiXCo3	Copper	42 - 44	1 - 4	0.4	900
15 TiXCo4	Grey	42 - 44	1 - 4	0.4	900
16 PSiX	Red brown	42 - 44	1 - 4	0.4	1100
17 BorAC	Grey	38 - 40	1 - 5	0.5	900
18 BorAX	Copper	42 - 44	1 - 4	0.4	1100
19 TiB2	Satin silver	32 / 38	1 - 5	0.4	600
20 WC/C	Dark grey	15 - 18	1 - 3	0.1 - 0.2	300
21 DLC1: TiCN + a-C:H:Me	Anthracite	36 / 20	1 - 3	0.1 - 0.2	400
22 DLC1: nACRo + a-C:H:Me	Anthracite	39 / 20	1 - 3	0.1 - 0.2	400
23 DLC2: TiN + a-C:H:Si	Anthracite	> 25	1 - 3	0.1 - 0.2	400
24 DLC2: CrN + a-C:H:Si	Anthracite	> 25	1 - 3	0.1 - 0.2	400
25 DLC2: CrTiN + a-C:H:Si	Anthracite	> 25	1 - 3	0.1 - 0.2	400
26a DLC3: Cr + ta-C/a-C in Pi411	From rainbow colors to anthracite	45 - 50	0,3 - 1	0.1	450
26b DLC3: Cr + ta-C/a-C in PL711	Anthracite	> 30	1 - 2	0.1	450
27 nACoX	Dark grey	30 - 32	4 - 10	0.5	1200

The given physical values may vary for different coating structures (mono-, gradient-, multi- and nanolayers).

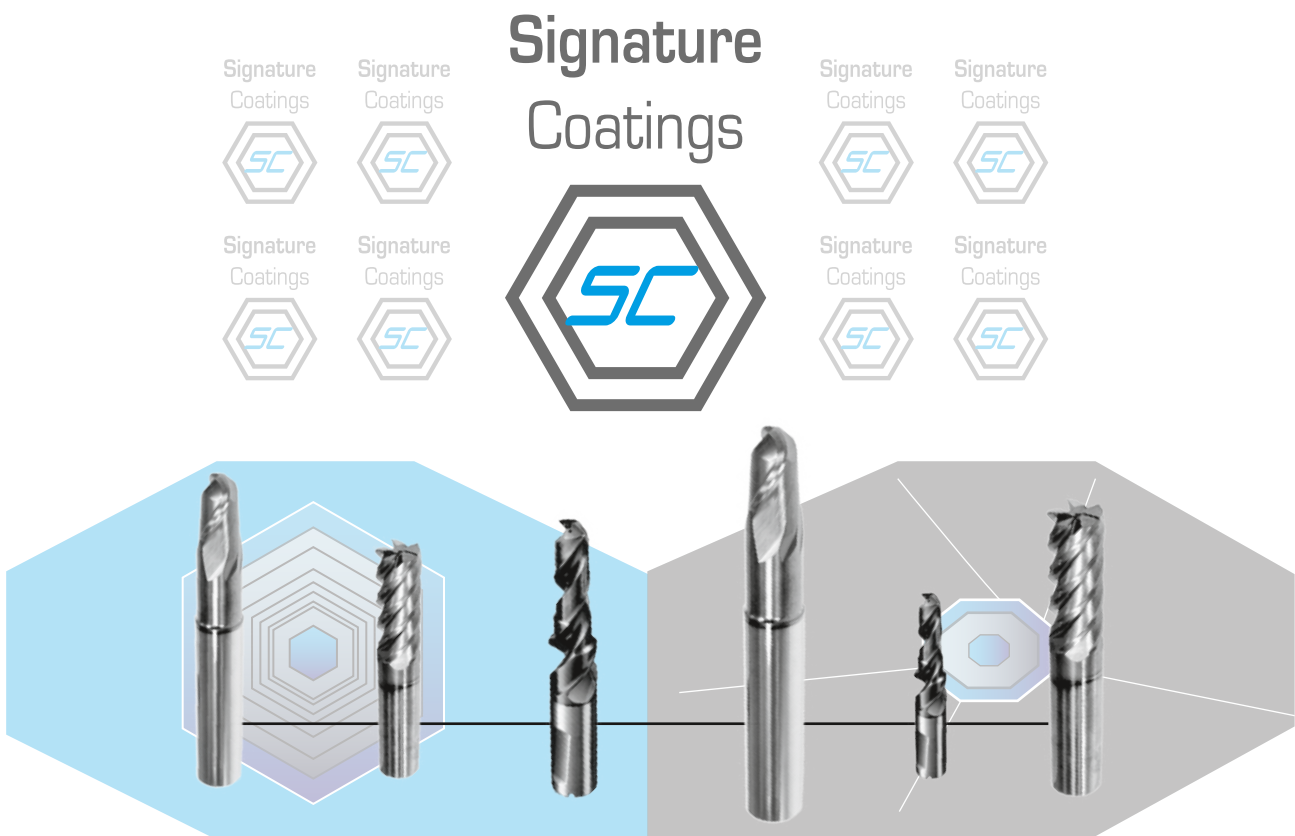
# Signature Coatings



## OVERVIEW

PLATIT's Signature Coatings are exclusively developed by our R&D teams using the unique features of the PLATIT technology. They combine years of experience and know-how in the field of coating development with the latest technical innovations.

Our Signature Coatings promise the highest performance for their dedicated applications in the field of cutting, forming and tribological components. PLATIT customers can differentiate themselves from competitors and stand out from the market standard with the deposition of Signature Coatings.

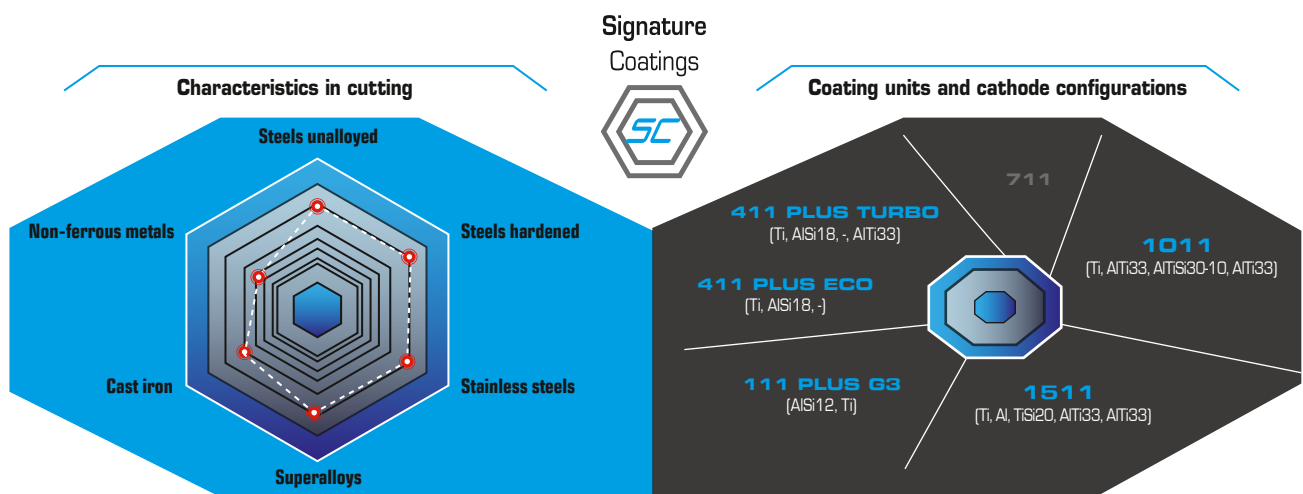


## UNIVERSAL NANOCOMPOSITE FOR MILLING AND DRILLING C-STEELS

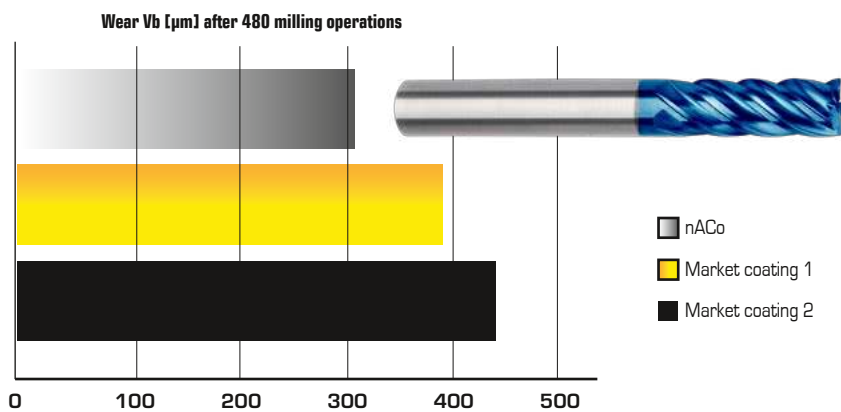
nACo is one of PLATIT's best-known coating brands. It has proven itself on the market for over 20 years. nACo is an AlTiSi-based nanocomposite coating and performs best in the field of milling and drilling C-steels. The use of nACo provides excellent adhesion and good performance even for more unusual applications such as milling with coated ceramic tools and CBN tools.

### Highlights:

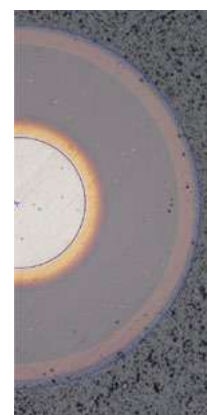
- Nanocomposite with Si content
- High temperature stability
- Good hardness
- Reduces adhesion to cutting-edges
- Versatile application possibilities



### Milling in SUS316 with solid carbide end mill D4:



Tool: solid carbide end mill; D4; z = 4; cutting length = 6 mm  
 Workpiece material: SUS316  
 Coolant; ap = 0.1 mm; ae = 4 mm; vc = 100 m/min; n = 8000 rpm; fz = 0.0625 mm/z;  
 f = 0.2500 mm/rot; vf = 2000 mm/min  
 Source: Chinese tool manufacturer



**Calo 3 layers**

AlTi(Si)N is deposited on a TiN adhesion layer

### Specifications

**Color** blue violet

**Nano-hardness [GPa]** 39 - 41

**Coefficient of friction [µ] PoD (at RT, 50 % humidity)** 0.4

**Coating thickness [µm]** 1 - 4

**Max. service temperature [°C]** 1200

**Coating temperature [°C]** 400 - 500

# TiXCo coatings



## TiXCo3 AND TiXCo4

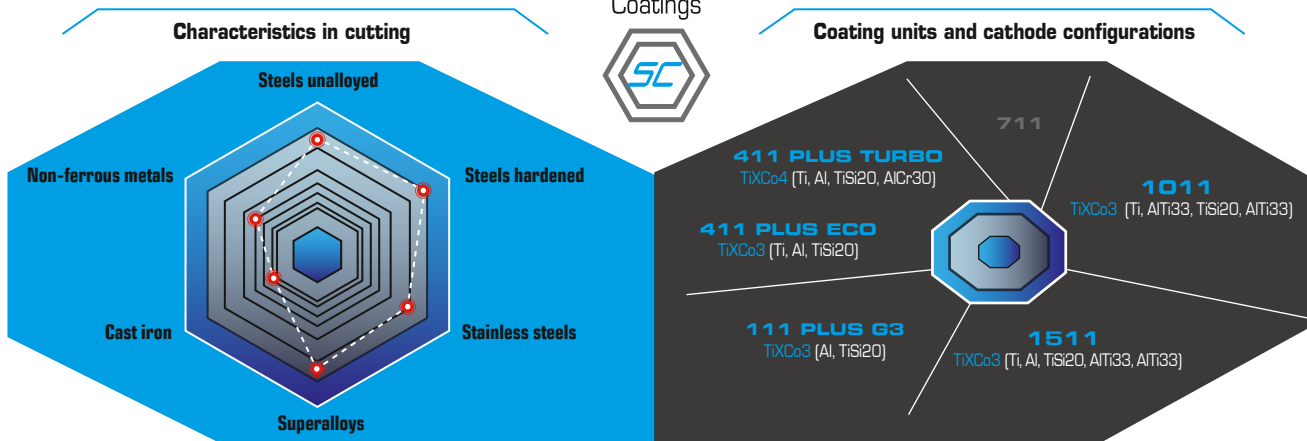
As our hardest nanocomposite, TiXCo3 is especially suitable for hard machining. It can be used at very high temperatures and is therefore suitable for finishing processes in milling and drilling. TiXCo3 also provides excellent performance for finishing turbine parts.

TiXCo4 is used for broadband applications.

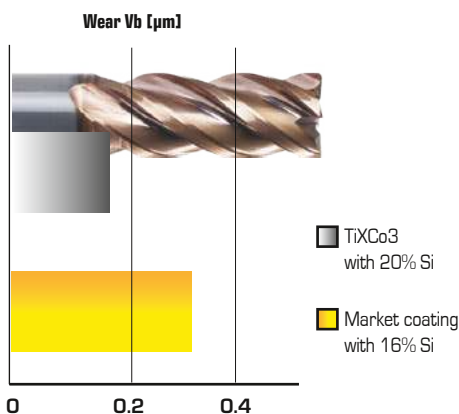
### Highlights:

- TiXCo3:
  - High surface quality
  - Extremely hard and very wear-resistant
  - For super-hard machining
- TiXCo4:
  - Wide range of application and use

### Signature Coatings

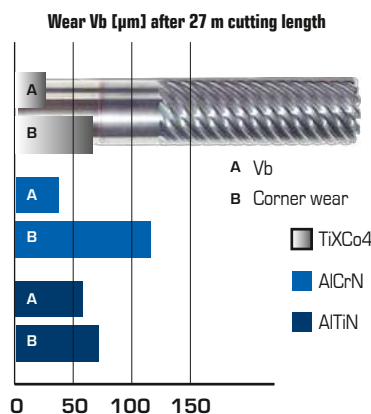


### Milling in X210Cr13 with solid carbide end mill D6:

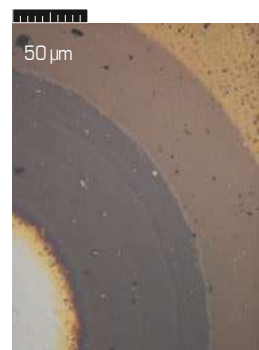


Tool: solid carbide end mill; D6  
 Workpiece material: X210Cr13; 1.2080; 64 HRC  
 Cooling: dry air; 5 bar; ap = 0.09 mm; ae = 0.06 mm;  
 n = 16 820 rpm; f = 0.1 mm/rot  
 Source: South Korean tool manufacturer

### Milling in SKD61 with solid carbide end mill D8:



Tool: solid carbide end mill; D8  
 cutting length = 27 m  
 Workpiece material: SKD61; 54 HRC  
 Emulsion; ap = 4 mm; ae = 0.03 mm; vc = 100 m/min  
 Source: Chinese tool manufacturer



### Calo 3 layers

TiXCo3: TiN -> AlTi(Si)N -> TiSiN  
 TiXCo4: TiN -> AlCrTi(Si)N -> TiSiN

### Specifications

**Color** copper with TiXCo3  
 grey with TiXCo4

**Nano-hardness [GPa]** 42 - 44

**Coefficient of friction [µ] PoD (at RT, 50 % humidity)** 0.4

**Coating thickness [µm]** 1 - 4

**Max. service temperature [°C]** 900

**Coating temperature [°C]** 450 - 500

## GENERIC COATING FOR CUTTING AND FORMING

ALL4 is an AlCrTiN universal coating. It covers a wide range of applications as well as workpiece materials. The coating is particularly suitable for materials that are difficult to machine.

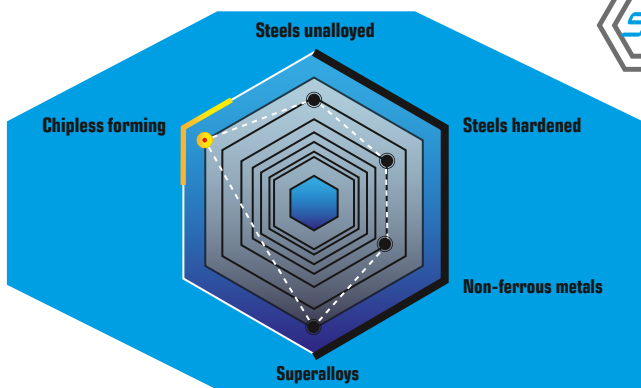
### Highlights:

- Covers many application processes in cutting and forming
- Suitable for different workpiece materials
- Very wear-resistant at high temperatures
- Heat-resistant and tough

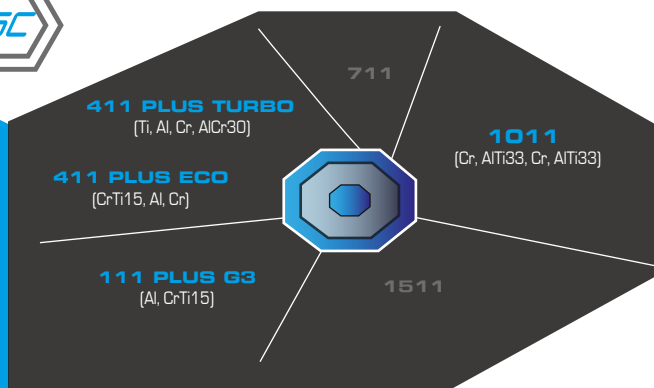
Signature Coatings



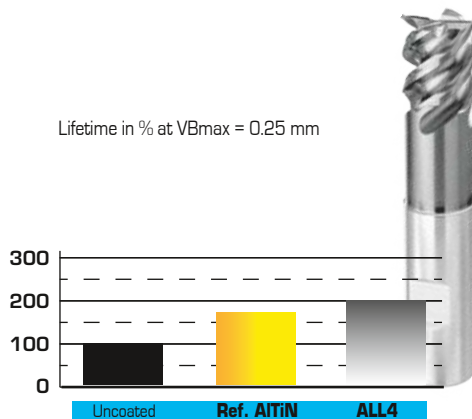
### Characteristic in cutting + chipless forming



### Coating units and cathode configurations

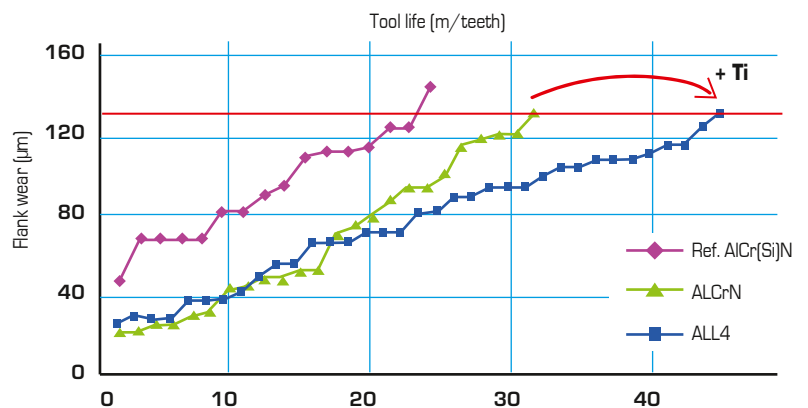


### Milling in Inconel 718:



Tool: roughing cutter; D10 x 22 / R1  
 Workpiece material: Inconel 718 (200 mm x 200 mm x 36 mm)  
 KSS: B-Cool 9665; ap = 12 mm (2x); ae = 0.1 mm; vc = 90 m/min; fz = 0.21 mm  
 Post-treatment: drag grinding / wet blasting  
 Source: GFE, Germany

### Flank wear with HSS hob in 20 MnCr 5:



Tool: HSS hob; D90  
 Workpiece material: 20 MnCr 5  
 Coolant air; mn = 2.3 mm; vc = 150 m/min; fa = 1.69 mm/rot; zo = 5  
 Max. chip thickness hcu = 0.347 mm  
 Source: IFG Magdeburg

### Specifications

Color: grey

Nano-hardness [GPa]: 36 - 38

Coefficient of friction [µ] PoD (at RT, 50 % humidity): 0.5

Coating thickness [µm]: 1 - 5

Max. service temperature [°C]: 900

Coating temperature [°C]: 400 - 500

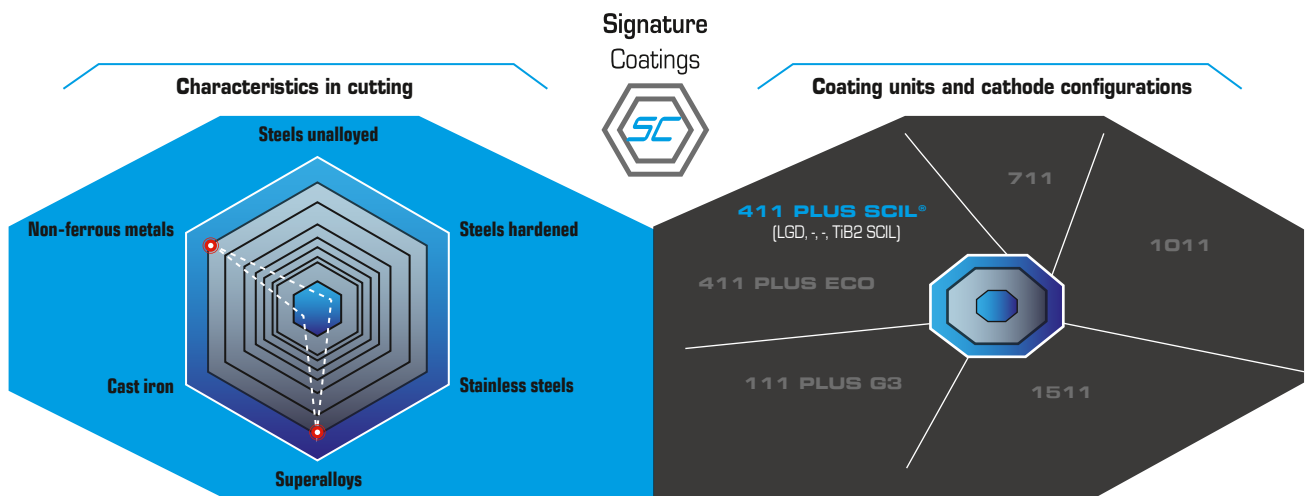


## SPUTTER COATING FOR ALUMINUM MACHINING

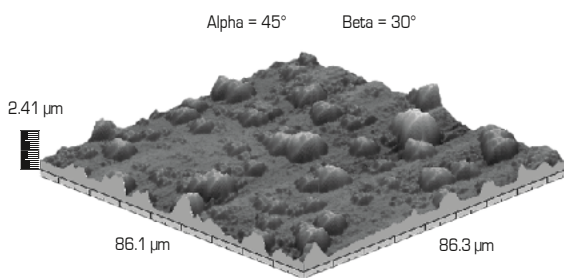
TiB2 is one of the most efficient PLATIT SPUTTER coatings. With a SCIL® configuration (SPUTTERED Coating Induced by Lateral Glow Discharge) nano-hardness of 32 GPa is achieved, which can be increased to 38 GPa with a hybrid LACS® configuration (Lateral ARC with central SPUTTERING). That means Ti alloys can be machined as well.

### Highlights:

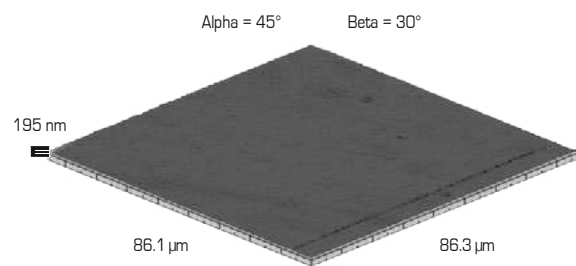
- Universal applications in aluminum
- Available in two versions: SPUTTERED SCIL® or hybrid LACS® coating
- Reduces adhesion to cutting-edge
- Increased wear-resistance



### Comparison of the roughness of coatings for aluminum machining:



**Zr-N**  
Coated with Pi411 with hybrid LACS® configuration



**TiB2**  
Coated with Pi411 with SCIL® configuration

Measured with AFM on a carbide test piece, same scale

### Specifications

**Color** satin silver

**Nano-hardness [GPa]** 32 - 38

**Coefficient of friction [μ] PoD (at RT, 50 % humidity)** 0.4

**Coating thickness [μm]** 1 - 5

**Max. service temperature [°C]** 600

**Coating temperature [°C]** 200 - 400

## SPECIALIST FOR HIGHLY DEMANDING MACHINING

BorAC is PLATIT's selected hybrid LACS® coating with simultaneous ARC and SPUTTER processes. BorAC consists of a boron-doped AlCrN protective coating, which is especially suitable for crack inhibition and thus for high-speed applications such as transmission and gear cutting tools. BorAC delivers top performance under high loads, especially in gear hobbing and roughing (dry and wet).

### Highlights:

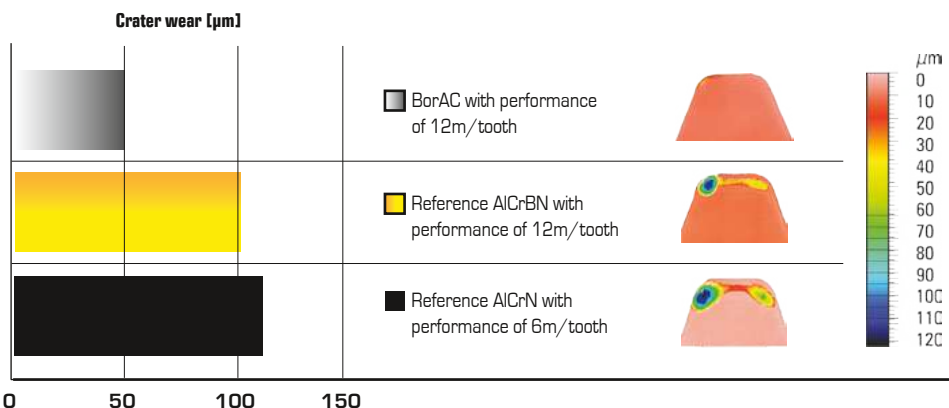
- Hybrid LACS® Coating
- Low coating residual stress
- Crack-resistant
- Minimizes crater wear

**Example: HSS hobs**

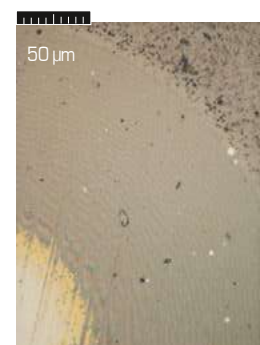
**Signature Coatings**

**Coating units and cathode configurations**

### Effect of boron doping on crater wear in hobs:



Tool: HSS hob; D100  
 Workpiece material: 20 MnCr 5  
 Cooling air; mn = 4 mm; vc = 220 m/min, fa = -6.4 mm/rot  
 Max. chip thickness hcu = 0.24 mm  
 Source: IFQ Magdeburg



**Calo 3 layers**

CrN adhesion layer -> AlCrN -> AlCrBN

### Specifications

**Color** grey

**Nano-hardness [GPa]** 38 - 40

**Coefficient of friction [μ] PoD (at RT, 50 % humidity)** 0.5

**Coating thickness [μm]** 1 - 5

**Max. service temperature [°C]** 900

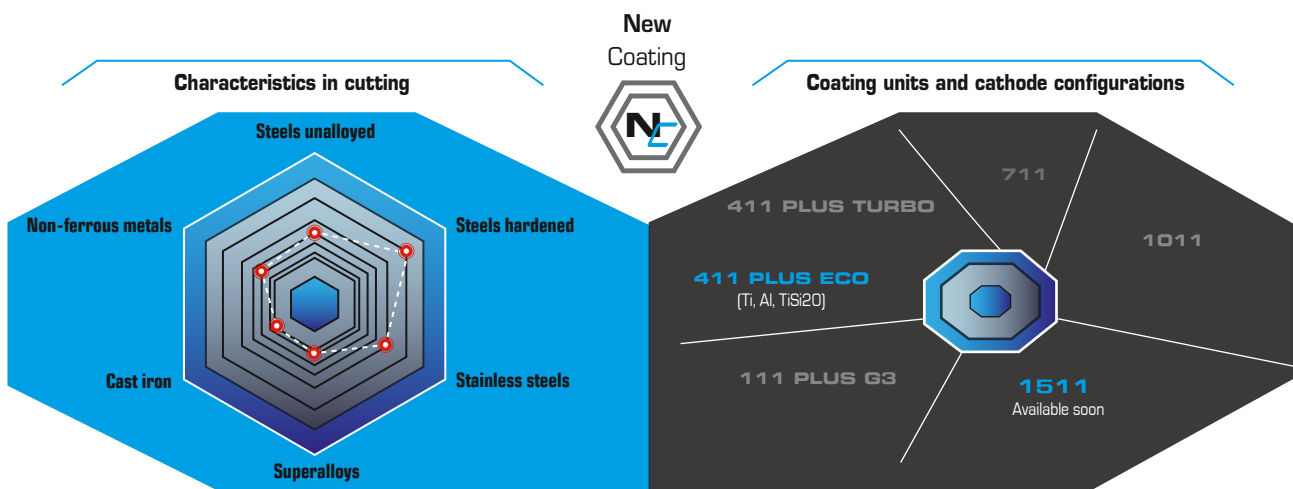
**Coating temperature [°C]** 400 - 500

## UNIVERSAL HARD MACHINING COATING

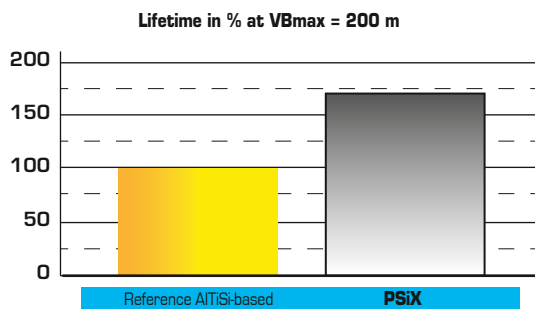
PSiX is a new PLATIT nanocomposite coating with a super-hard top layer. PSiX is based on TiXCo3 but has a silicon-free AlTiN base. Therefore, the aluminum content of PSiX is higher, which increases the coating's thermal stability. The coating is temperature-optimized and therefore excellent for hard machining processes like finishing and roughing.

### Highlights:

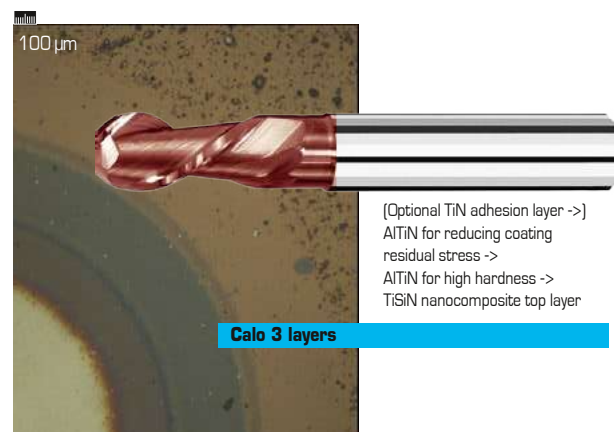
- Thermal stability
- Temperature-optimized
- Low coating residual stress



### Ball nose end mill in 61 HRC:



Tool: ball nose end mill; D10  
 Workpiece material: 1.2379; 61 HRC  
 ap = 0.2 mm; ae = 0.5 mm; vc = 182 m/min; fz = 0.14 mm  
 Source: GFE, Germany



### Specifications

**Color** red brown

**Nano-hardness [GPa]** 42 - 44

**Coefficient of friction [µ] PoD (at RT, 50 % humidity)** 0.4

**Coating thickness [µm]** 1 - 4

**Max. service temperature [°C]** 1100


**Coating temperature [°C]** 450 - 500

## SOLUTION FOR GRAPHITE MACHINING AND FOR NON-FERROUS METALS

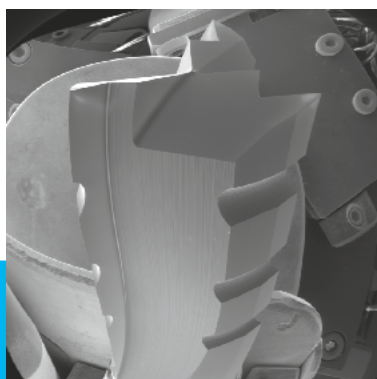
ta-C belongs to the PLATIT DLC3 hydrogen-free coating generation with over 50 % sp<sup>3</sup> content. The high sp<sup>3</sup> bond fraction results in a higher density, hardness (at ambient and elevated temperature), thermal stability, oxidation resistance, residual stress and lower thermal conductivity. Depending on the application from micro-tools to components, ta-C can be deposited by the PLATIT Pi411 or PL711 coating units.

### Highlights:

- Over 50 % sp<sup>3</sup> content
- High density and hardness
- Thermal stability
- Oxidation resistance
- High residual stress
- Low thermal conductivity

Coating unit <b>411</b>		New Coating 	Coating unit <b>711</b>	
Cathode configuration LGD, -, Cr, C SCIL			Cathode configuration Cr, C	
ta-C + a-C (over 50 % ta-C)	<b>Composition</b>		ta-C + a-C (up to 50 % ta-C)	
Tools	<b>Main application</b>		Components	
SPUTTERING	<b>Process</b>		SPUTTERING	
From rainbow colors to anthracite	<b>Color</b>		Anthracite	
0.3 - 1	<b>Coating thickness [µm]</b>		1 - 2	
350 - 450	<b>Young's modulus [GPa]</b>		350 - 450	
45 - 50	<b>Nano-hardness [GPa]</b>		> 30	
Ra ~ 0.06 µm	<b>Roughness</b>		Ra ~ 0.02 µm	
Rz ~ coating thickness			Rz ~ coating thickness	
	<b>Coefficient of friction [µ] PoD (at RT, 50 % humidity)</b>			
~ 0.1			~ 0.1	
450	<b>Max. service temperature [°C]</b>		450	
< 150	<b>Coating temperature [°C]</b>		180 - 250	
CFRP composite material	<b>Workpiece material</b>		Steel	

DLC3 coated endmill under scanning electron microscope:





PLATIT COATING INTELLIGENCE



SWISS MADE



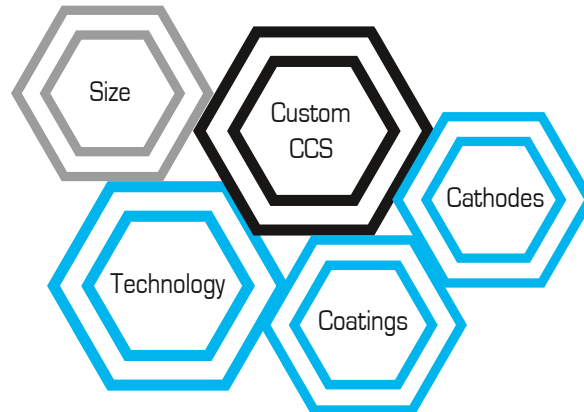
SWISS MADE



plait.com

## CCS - CUSTOM COATING SOLUTIONS

PLATIT's Custom Coating Solutions meet any special requirements. They are user-defined in every respect:



Engineers and technicians from PLATIT in the CCS (Custom Coating Solutions) division in Switzerland advise customers and design, develop, manufacture and program systems according to the individual requirements. They develop solutions in close exchange with customers and accompany them over the years by providing support and supplying spare parts.

For this purpose, PLATIT has established a network of companies for cooperation in the production of components. PLATIT also manufactures special holders as well as handling devices and works together with various partners to offer peripheral equipment adapted to the Custom Coating Solutions.

For inspiration, the following pages show different sample applications for which PLATIT has already developed, manufactured and delivered coating systems.



## SAW BANDS

The biggest challenge in the handling as well as coating of saw bands is their size as they are wound on a tool carrier, the coil. Due to circumferential speed, layer growth can result in varying coating thickness.

PLATIT has mastered this problem by developing and manufacturing a Custom Coating Solution:

- To improve the handling, the coating chamber door opens sideways; the opened chamber door can be swiveled by 90° so the loading and unloading can take place from the left-hand side
- The coil is arranged at a certain angle to the deposition technology to ensure a constant coating thickness distribution
- The LGD® (Lateral Glow Discharge) process is used for etching and improved coating adhesion
- To guarantee a uniform coating, the teeth and the back of the saw band are coated by different cathode types
- The coating process takes place at a maximum temperature of 500 °C to ensure that the physical and chemical properties of the saw band remain unchanged
- Coating increases the lifespan of saw bands and improves the cutting performance during sawing; the development of tool wear is reduced

### Sample Custom Coating Solution \_Pi603

In order to meet the product-specific requirements, PLATIT has designed a turnkey system with a PVD coating unit operating at a high vacuum as well as a tailor-made single-chamber cleaning system. The saw bands are wound as a coil and are both cleaned and coated with the same product carrier to avoid additional effort.

The Pi603 was built in 2006 and is still working perfectly today. PLATIT's design proved to be very user-friendly. Even customers who are not experienced with such technologies can operate this unit with ease. Pursuant to the open-source principle, PLATIT has transferred its knowledge to the customers so that they can benefit from the advantages of LARC® cathodes and flexibly combine as well as develop their own coatings.

## SAW BANDS

### Specifications\_Sample Custom Coating Solution Pi603

#### Technologies applied:

- 3 x LARC® cathode by PLATIT with ARC technology
- 1 x Planar ARC cathode for uniform coating of the backs of saw bands

#### Etching technologies applied:

- LGD®
- Plasma etching with argon, glow discharge
- Metal ion etching (Ti, Cr)

#### Load and cycle times:

- 2 batches/day with a batch time of 8.5 - 10 h
- Saw band diameter up to 1360 mm
- Inner packing diameter: 560 mm
- Saw band height up to 100 mm
- Saw band weight incl. carrier up to 600 kg

#### Software:

- Simple use and maintenance
- PLATIT SmartSoftware (PC and PLC system)
- Modern control system with touch screen
- Data recording and real-time display of process parameters and flow
- Manual and automatic process control
- Remote diagnostics and maintenance


#### Machine dimensions:

- Footprint: W 5900 x D 6450 x H 3100 [mm]

# CCS

Pi603



Targets 3	Targets 1	Cycle ≥ 8.5 h	Max. Load 600 kg	Solution Turnkey	Service Custom
					



## SAW BLADES

A rail system ensures that the carousel trolley is always correctly aligned with the chamber, thereby making the loading and unloading of loads of up to 1800 kg easy. The height of the custom-designed carousel trolley can be adjusted at the touch of a button.

# CCS

PL2011



When it comes to coating saw blades, the biggest challenge is to find a coating unit that can efficiently coat large quantities in a single batch at a high level of quality without damaging the saw blades. Due to their high content of heat-sensitive steel, accurately controlling the process temperature is essential. Too high process temperatures will deform the saw blade, by meaning it will no longer cut true.

PLATIT designs special coating units to meet these challenges:

- The PVD unit has a temperature control system for coating saw blades; the temperature is kept within a very narrow range
- The use of ARC power supplies on alloyed targets improves the deposition rate and coating distribution, ensures uniform erosion and extends the target material's lifespan
- Pulsed cathodes and improved ARC distribution produce smoother coatings
- The coating chamber is suitable for large tools and substrates
- The modular carousel design provides maximum loading flexibility

### Sample Custom Coating Solution\_PL2011

For the coating of large saw blades up to a  $\varnothing$  of 1423 mm (56"), PLATIT has built a high-capacity coating unit. A custom-designed carousel with 6 configurations allows for maximum loading flexibility while maintaining the quality of the coating. Tools with a small or large diameter or mixed loads can be coated in one batch.

The unit is equipped with two doors to provide:

- Optimal access to the chamber
- Simplified maintenance of both the machine and the cathodes
- Simplified batch management since a completed batch can be removed through one door and the next batch loaded immediately via the other door

# Custom Coating Solutions



## SAW BLADES

### Specifications\_Sample Custom Coating Solution PL2011

#### Technologies applied:

- 6 x Planar ARC cathode, 4 of which pulsed with ARC power supplies

#### Etching technologies applied:

- LGD® (Lateral Glow Discharge) with 2 cathodes with a shutter and 2 cathodes acting as anodes
- Plasma etching with argon, glow discharge
- Metal ion etching (Ti, Cr)

#### Load and cycle times:

- Coating volume up to  $\varnothing$  1400 x H 700 [mm]
- Load up to 1800 kg

#### 2 - 5 batches/day for\*:

Shank tools	$\varnothing$ 10 x 70 [mm]	2016 pcs.	4 - 5 h
Inserts	$\varnothing$ 20 x 6 [mm]	13200 pcs.	4 - 5 h
Saw blades	$\varnothing$ 250 [mm]	250 pcs.	8 - 9 h
Saw blades	$\varnothing$ 350 [mm]	200 pcs.	8 - 9 h
Saw blades	$\varnothing$ 460 [mm]	150 pcs.	8 - 9 h
Saw blades	$\varnothing$ 650 [mm]	75 pcs.	8 - 9 h
Saw blades	$\varnothing$ 1423 [mm]	20 pcs.	8 - 9 h

\* Average cycle times for a typical coating mix in a production environment.

#### Software:

- Simple use and maintenance
- PLATIT SmartSoftware (PC and PLC system)
- Modern control system with touch screen
- Data recording and real-time display of process parameters and flow
- Manual and automatic process control
- Remote diagnostics and maintenance

#### Machine dimensions:

- Footprint: W 8000 x D 5800 x H 2350 [mm]



<b>Targets</b> 6	<b>Cycle</b> ≥ 4 h	<b>Max. Load</b> 1800 kg	<b>Solution</b> Turnkey	<b>Service</b> Custom

## ROLLERS AND BROACHES

Because of their weight, large sizes and special geometry, rollers and broaches are difficult to handle and not suitable for coating in standard coating units.

PLATIT develops Custom Coating Solutions tailored to special applications:

- The unit is set to lower system temperatures for heat-sensitive tools and machine components made of high-speed steel
- The vacuum system is further developed for steady coating thickness distribution for large chamber volumes
- The design and handling concept are specially adapted to the weight and size of the tools, ensuring easy operation and maximum user comfort

### Sample Custom Coating Solution\_Mega-PiMS

PLATIT has designed a Custom Coating Solution with simplified loading in which the rollers are positioned horizontally. The cathode is located at the bottom of the coating chamber. PLATIT's SPUTTER technology is used to guarantee smooth coatings for high-gloss-polished or textured surfaces.



## ROLLERS AND BROACHES

### Specifications\_Sample Custom Coating Solution Mega-PiMS

#### Technologies applied:

- 1 x SPUTTER cathode
- 1 x anode on the opposite side

#### Etching technologies applied:

- LGD® (Lateral Glow Discharge)
- Plasma etching with argon, glow discharge

#### Load and cycle times:

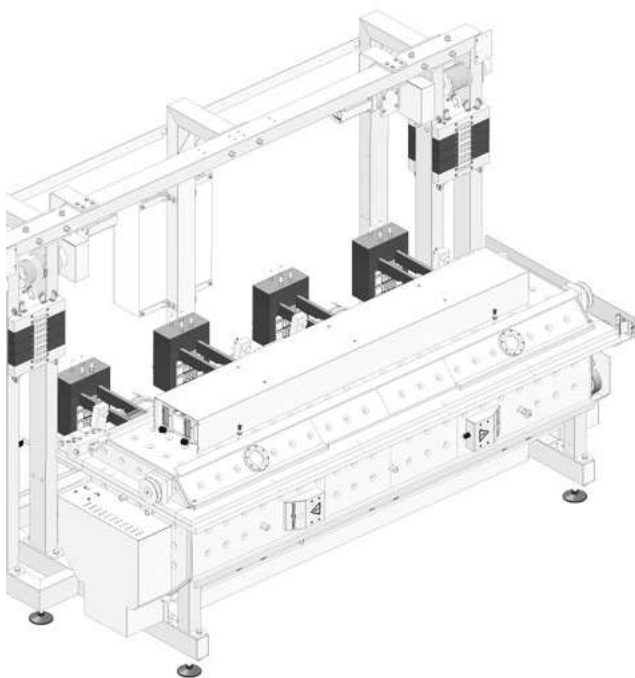
- 2 - 4 batches / day with a batch time of 6 - 12 h, depending on rollers
- Coating volume up to  $\varnothing$  600 x L 3000 [mm]
- Coating volume with defined coating thickness up to  $\varnothing$  600 x L 2000 [mm]
- Load up to 1500 kg

#### Software:

- Simple use and maintenance
- PLATIT SmartSoftware (PC and PLC system)
- Modern control system with touch screen
- Data recording and real-time display of process parameters and flow
- Manual and automatic process control
- Remote diagnostics and maintenance

#### Machine dimensions:

- Footprint (coating unit with electrical cabinet): W 4100 x D 2900 x H 2700 + W 1900 x D 1100 x H 2200 [mm]



Targets  
1



Cycle  
 $\geq$  6 h



Max. Load  
1500 kg



Solution  
Turnkey



Service  
Custom



## EXTRA-LONG BROACHES

### Sample Custom Coating Solution\_PL2511

PLATIT has designed a Custom Coating Solution for coating extra-long broaches. The coating unit and loading system are embedded into a special foundation in the production hall. The coating solution is highly flexible, allowing for the loading of homogenous loads of tools or mixed loads with broaches, punches, big forming and stamping tools and even molds and dies in one batch.

### Specifications\_Sample Custom Coating Solution PL2511

#### Technologies applied:

- 6 x Planar ARC cathode

#### Etching technologies applied:

- Plasma etching with argon, glow discharge
- Metal ion etching (Ti, Cr)

#### Load:

- Coating volume with defined coating thickness:  $\varnothing$  700 x H 700 to 2500 [mm]
- Length of a broach up to 2500 mm
- Load up to 2000 kg, heavier loads on request

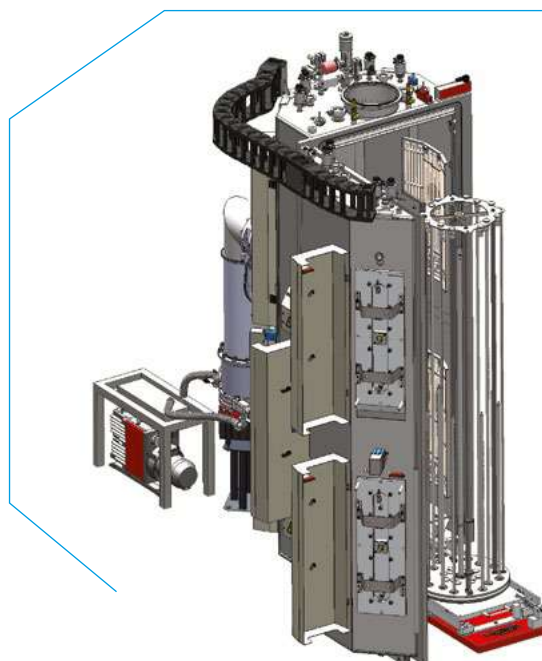
#### Carousel systems:





- Single, double and triple rotation in a carousel

#### Software:

- Simple use and maintenance
- PLATIT SmartSoftware (PC and PLC system)
- Modern control system with touch screen
- Data recording and real-time display of process parameters and flow
- Manual and automatic process control
- Remote diagnostics and maintenance

**CCS**   
PL2511



Targets	Max. Load	Solution	Service
6	On request	Turnkey	Custom
			

## PUNCHES

When coating stamps and punches, ensuring surface quality is essential. These surfaces require smooth, dustless coatings with good adhesion to accurately replicate highly detailed relief structures. Stamps and punches have narrow tolerances and can only be coated within a certain temperature range.

PLATIT fulfills these requirements with its Custom Coating Solution:

- The surface to be coated faces downwards to keep it dust-free; the target is placed on the underside of the coating chamber
- SPUTTER technology from PLATIT, supported by LGD® (Lateral Glow Discharge), guarantees smooth coatings with very good adhesion
- The temperature is kept within a narrow range

### Sample Custom Coating Solution\_S-MPuls

For coin punches, PLATIT has developed a Custom Coating Solution for high-quality coatings with a good amorphous structure as well as high density, surface quality and reproduction accuracy.

### Specifications\_Sample Custom Coating Solution S-MPuls

#### Technologies applied:

- 1 x DC-pulsed magnetron SPUTTER cathode with a rotating magnetic field
- SPUTTER source arranged at the bottom of the chamber



#### Etching technologies applied:

- LGD®
- Plasma etching with argon, glow discharge, with auxiliary anode

#### Load and cycle times:

- 4 - 6 batches/day with a batch time of 3.5 h
- Coating volume with defined coating thickness:  $\varnothing$  70 - 250 [mm]
- Substrate holder:  $\varnothing$  300 mm, varying customer-specific versions possible
- Load up to 20 kg

#### Software:

- Simple use and maintenance
- PLATIT SmartSoftware (PC and PLC system)
- Modern control system with touch screen
- Data recording and real-time display of process parameters and flow
- Manual and automatic process control
- Remote diagnostics and maintenance

#### Machine dimensions:

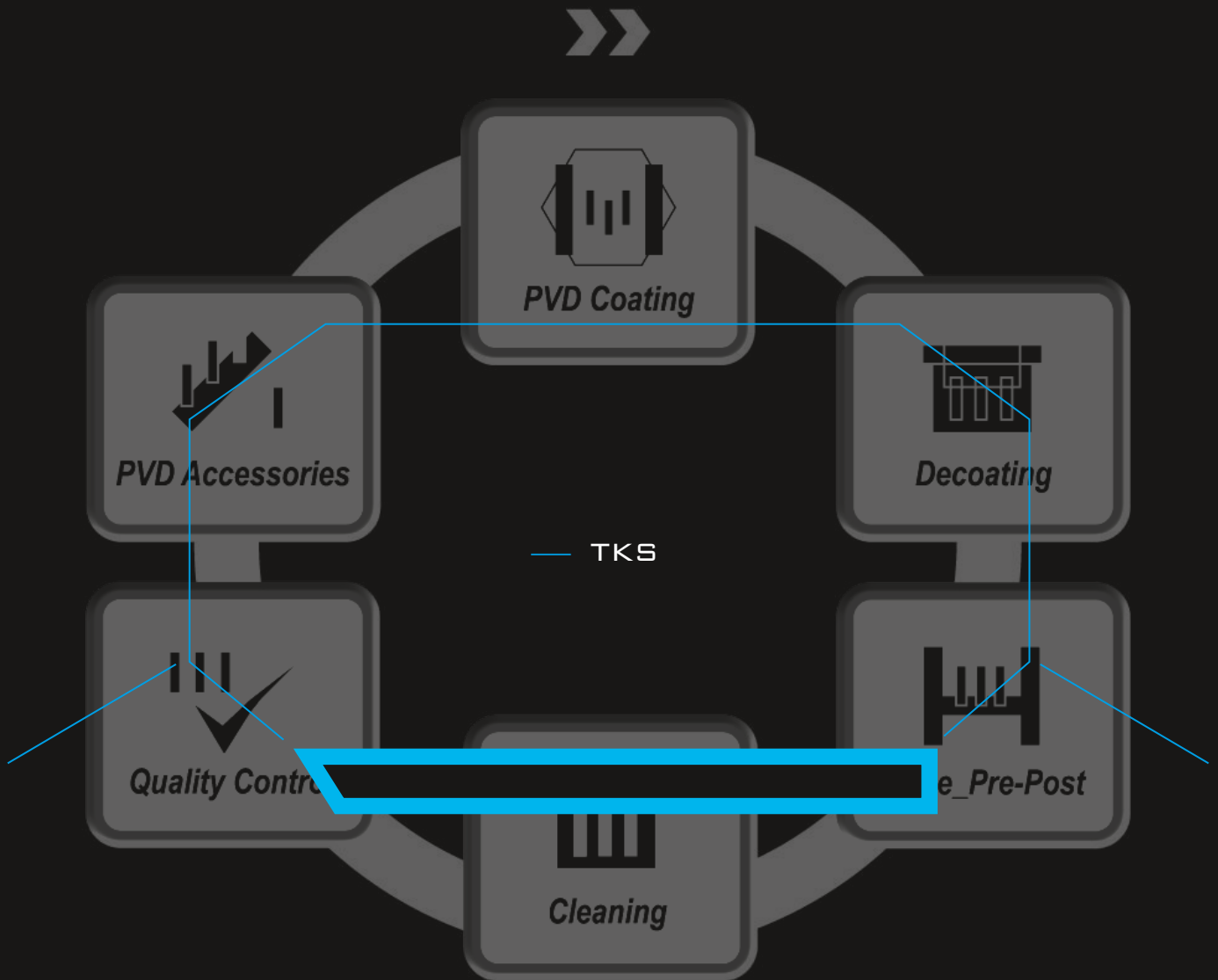
- Footprint (coating unit with electrical cabinet):  
W 945 x D 1403 x H 2068  
+ W 608 x D 1369 x H 2068 [mm]



Targets	Cycle	Max. Load	Solution	Service
1	≥ 3.5 h	20 kg	Turnkey	Custom
				



## PLATIT COATING INTELLIGENCE



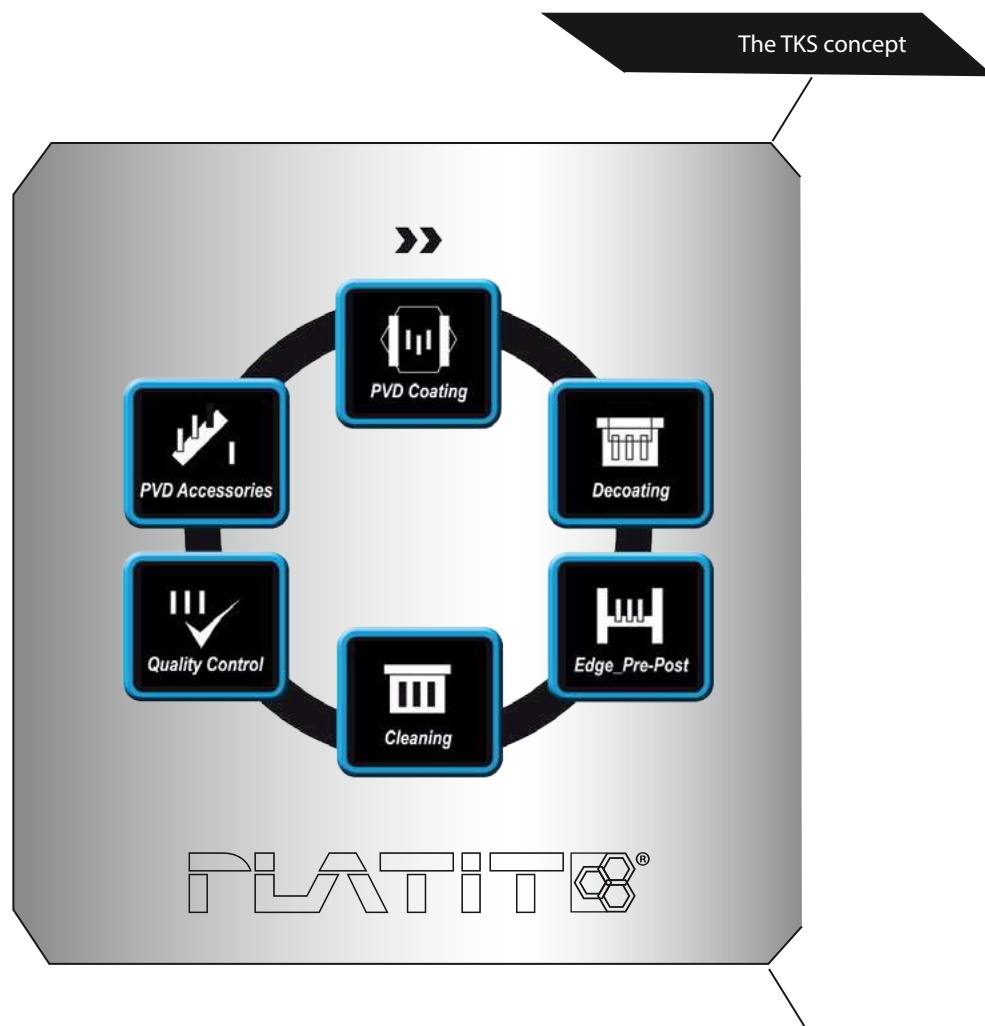
PLATIT® 11 - Series

## OVERVIEW

PLATIT's turnkey system with complete solutions for upstream and downstream steps for hard coating is ideally suited for seamless integration into the tool manufacturing and regrinding process.

PLATIT provides and integrates everything needed for a successful coating center:

- Depending on the requirements, different dimensions of coating chambers for the coating of small to oversized substrates
- Comprehensive coating know-how
- Equipment for decoating high-speed steel and carbide
- Equipment for edge pre-treatment
- Vacuum-assisted single-chamber cleaning units
- Systems for easy quality control of the coating
- Equipment for post-treatment, such as polishing
- PVD production accessories from sleeves to handling systems and chillers

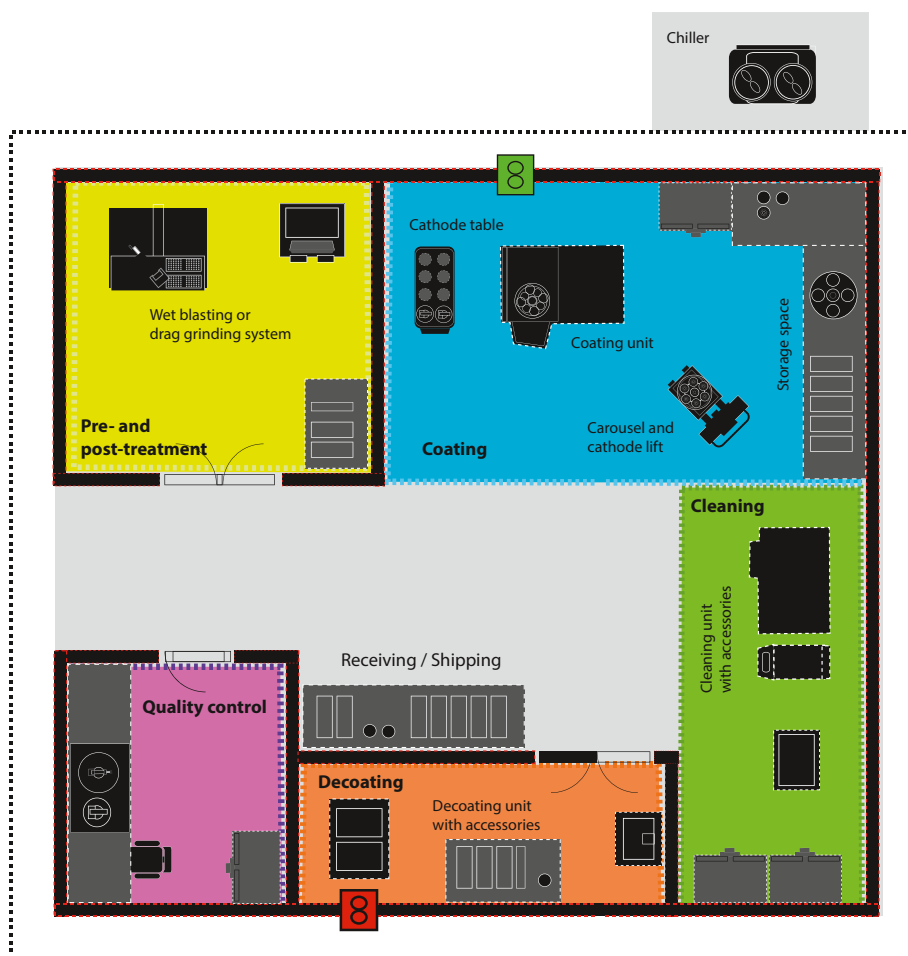




## PLANNING AND IMPLEMENTATION

### View\_TKS Layout

PLATIT cooperates with partner companies to offer a wide range of peripheral equipment for upstream and downstream steps of the coating process. Flexibly tailored to the various applications, PLATIT's processes are integrated into its customers' tool manufacturing and thus guarantee an independent, stable and innovative production process.



Typical workflow in a coating center with PLATIT's turnkey solutions:

- |    |                              |     |                          |
|----|------------------------------|-----|--------------------------|
| 1. | Receipt of goods             | 7.  | Coating                  |
| 2. | Preliminary cleaning         | 8.  | Unloading of a batch     |
| 3. | Optional: decoating          | 9.  | Optional: post-treatment |
| 4. | Optional: edge pre-treatment | 10. | Quality control          |
| 5. | Fine-cleaning                | 11. | Goods output             |
| 6. | Preparation for coating      |     |                          |

Some modules (decoating, pre- and post-treatment) should be set up in a separate room from the coating units. Chiller must be placed separately.

## OVERVIEW

Decoating / stripping is an important prerequisite for recoating at a high level of quality. The old, used coating is removed so that the new one will adhere well to the reground tool and achieve a high degree of performance. Regrinding without decoating leads to a reduction of the tool's lifespan.

### Decoating in coating centers\_Conventional process

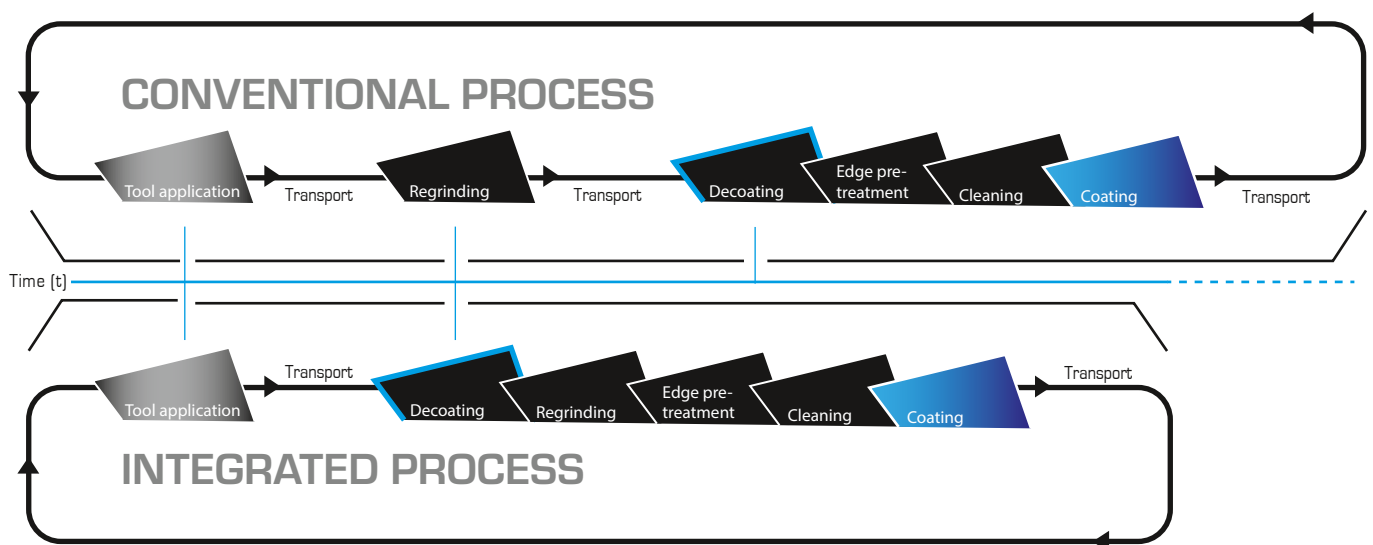
In coating centers, tools are usually decoated after regrinding. However, decoating after regrinding can damage the final geometry of the tool and increase the risk of poor adhesion. In addition, packaging, transport and repackaging involve the risk of damaging the tool.

### Decoating integrated into the tool regrinding process\_Integrated process

By integrating the decoating process into the tool regrinding, decoating can take place before the regrinding.

Advantages:

- Elimination of transport and packaging
- Less damage caused by handling
- Chemical destruction after regrinding is prevented
- Edge pre-treatment is fully effective
- Adhesion is optimized
- The tool performs almost as well as a new one



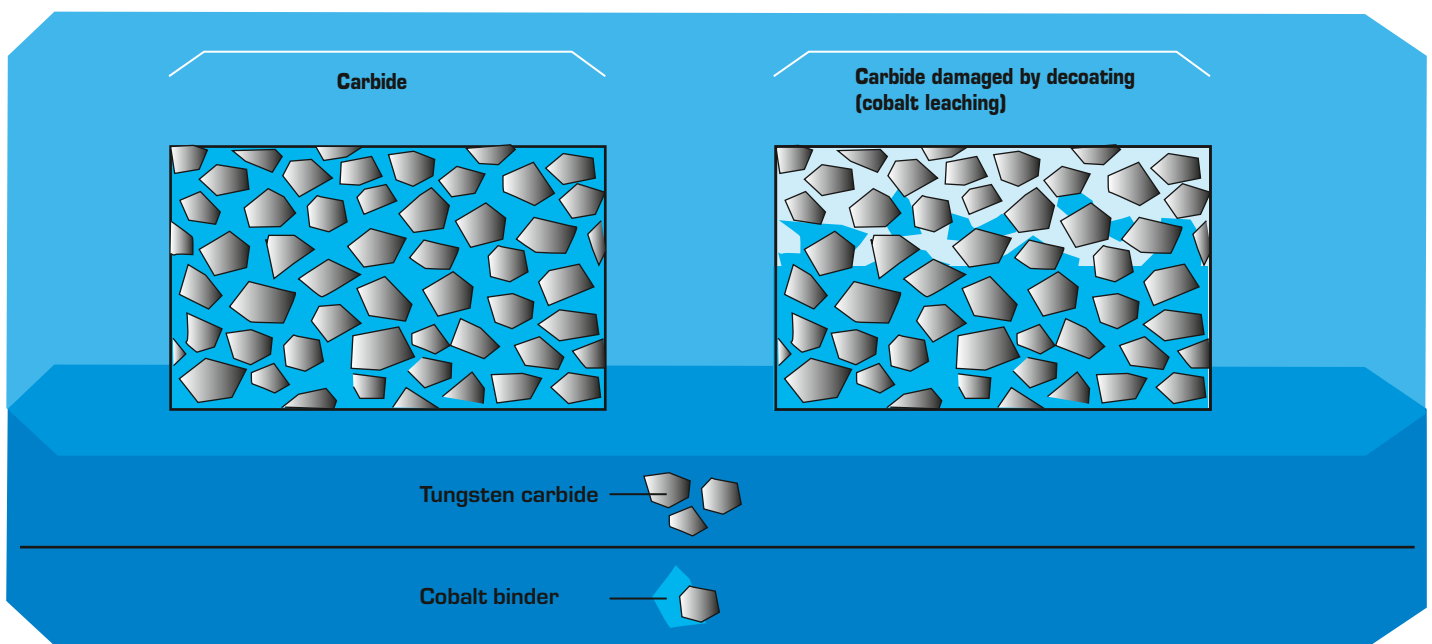
## COBALT LEACHING

In decoating carbide, the biggest challenge is to avoid damaging the substrates. The most common damage is caused by cobalt leaching.

Cobalt leaching refers to the removal of the cobalt binder from the top layer of the carbide. The most common reasons are:

- Chemical decoating
- Aqueous cleaning
- Water-cooled grinding
- Grinding too fast with a blunt grinding wheel

The coating of cobalt-leached carbide is not effective. Although the coating will adhere well to the top tungsten carbide layer, the tungsten carbide, along with the coating, will not adhere to the base material due to the lack of cobalt binder.



### PLATIT<sub>®</sub> Decoating unit concepts

PLATIT offers two types of decoating units—for carbide and high-speed steel—which can be customized according to the customer's requirements.

## DECOATING UNITS

### PLATIT CT20 (patented)\_Ultra-fast decoating unit


CT decoating systems from PLATIT set new standards in decoating, especially for carbide tools. The problem of cobalt leaching is circumvented by protecting the substrate with a TiN adhesion layer as the decoating process of the CT systems will not attack the TiN layer. For the CT20, the decoating cycle all the way to the TiN adhesion layer will take less than three minutes. The end of the process is automatically detected by built-in electronics. The adhesion layer is not removed and therefore «overcoated» after regrinding and pretreatment. A service life comparable to that of a new tool is achieved.

Features

**Fastest decoating process worldwide**

**Multiple coatings can be removed as well**

**Decoating time is less than 3 minutes all the way to the TiN adhesion layer**



**Environm. friendly**

**Common chemicals available worldwide**


**Decoating cycle stops automatically at TiN adhesion layer**

**CT20**

Max. tool dimensions ø 200 x 250 mm

Additional advantages:

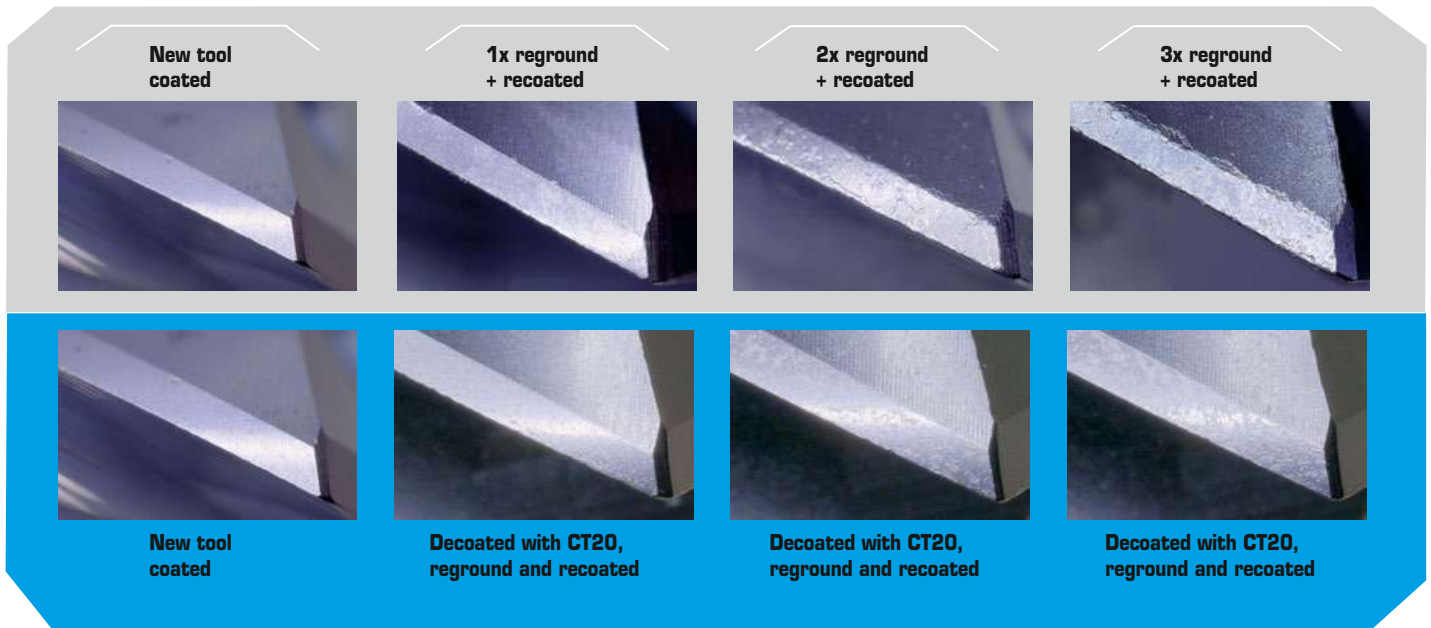
- A single recipe for a wide variety of nitride coatings with a TiN adhesion layer, independent of tool size
- Special holders for shank tools, hobs, inserts etc. to avoid attacking uncoated areas
- The process takes place at room temperature, neither heating nor cooling is required
- The end of the process will be automatically detected, which greatly simplifies the operator's work

	Pi111	Pi411	PL711	PL1011	Pi1511	
TiN	N	N	N	N	N	
TiCN		N		N		
TiAlN	Y	Y		Y		3 min*
TiAlCN		Y		Y		3 min*
AlTiN	Y	Y		Y	Y	3 min*
CrN	OPT	OPT	N	OPT		2 min*
CrTiN	Y	Y		Y		3 min*
ZrN	Y	Y		Y		2 min*
AlCrN	N	OPT		N	OPT	2 min*
AlTiCrN	Y	Y		N		3 min*
ALL4	N	OPT		N		3 min*
nACo	Y	Y		Y	Y	3 min*
nACRo	N	OPT		N	OPT	3 min*
TiXCo3	N	Y		Y	Y	3 min*
TiXCo4		Y				3 min*
PSiX		OPT				3 min*
BorAC		OPT			OPT	2 min*
BorAX		N				

\* Up to the TiN adhesion layer  
 \* Decoating time for 2 µm, ø 10 mm  
 Y = can be decoated with CT20 / N = cannot be decoated with CT20  
 OPT = optionally decoatable, depends on other factors  
 Empty = coating cannot be deposited by the specific coating unit

# REGRINDING

Regrinding and recoating without decoating  
 Decoating with CT20, regrinding and recoating



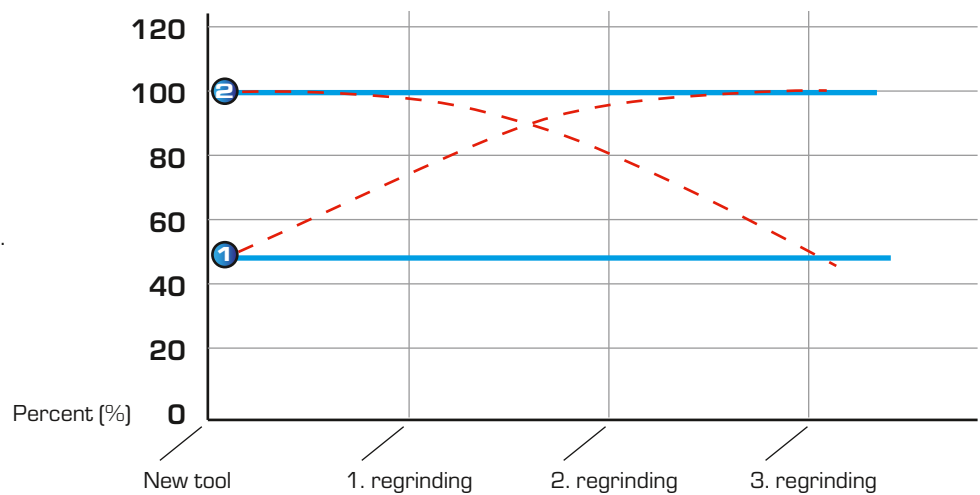
Explanation:

**Red**

Without decoating, roughness increases and tool life decreases.

**Blue**

Roughness and tool life remain constant, if the tool gets decoated with PLATIT CT20 before regrinding.



Without decoating

Roughness

Tool life

Decoating with CT20

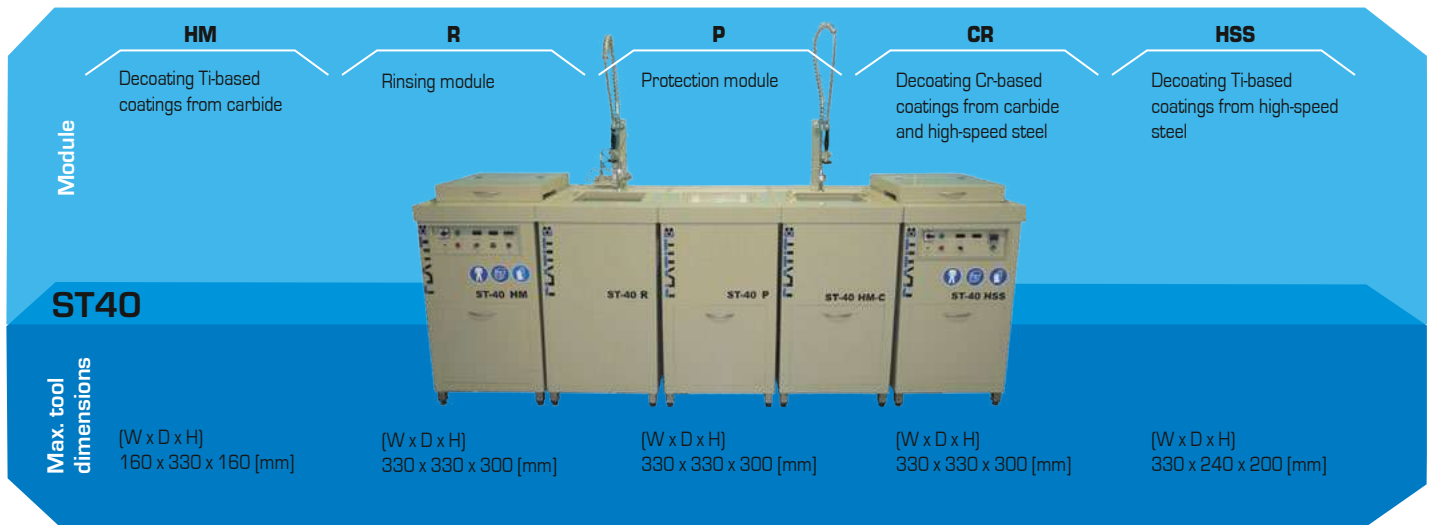
Roughness

Tool life

## DECOATING UNITS

### PLATIT ST40\_Conventional decoating unit

ST decoating units from PLATIT stand for great safety and flexibility. Depending on the module, they decoat Ti- or Cr-based coatings on carbide or high-speed steel.



### ST40\_Carbide shank tools

A	B <sub>1</sub>	C	D
TiN	4 - 5 h	T-HM	HM
TiCN	6 - 8 h	T-HM	HM
TiAlN	10 - 18 h	T-HM	HM
TiAlCN	-	-	-
AlTiN	10 - 18 h	T-HM	HM
CrN	0,5 - 3 h	C	Cr
CrTiN	-	-	-
ZrN	-	-	-
AlCrN	0,5 - 2 h	C	Cr
AlTiCrN	-	-	-
ALL4	-	-	-
nACo	9 - 11 h	T-HM	HM
nACRo	0,5 - 2 h	C	Cr
TiXCo <sub>3</sub>	5 - 9 h	T-HM	HM
TiXCo <sub>4</sub>	-	-	-
PSiX	10 - 18 h	T-HM	HM
BorAC	-	-	-
BorAX	-	-	-

### ST40\_High-speed steel hobs

A	B <sub>2</sub>	C	D
TiN	~ 1 h	T-HSS	HSS
TiCN	~ 2 h	T-HSS	HSS
TiAlN	1 - 2 h	T-HSS	HSS
TiAlCN	-	-	-
AlTiN	1 - 2 h	T-HSS	HSS
CrN	0,5 - 3 h	C	Cr
CrTiN	-	-	-
ZrN	-	-	-
AlCrN	0,5 - 2 h	C	Cr
AlTiCrN	-	-	-
ALL4	-	-	-
nACo	0,5 - 2 h	T-HSS	HSS
nACRo	0,5 - 2 h	C	Cr
TiXCo <sub>3</sub>	1 - 3 h	T-HSS	HSS
TiXCo <sub>4</sub>	-	-	-
PSiX	1 - 2 h	T-HSS	HSS
BorAC	-	-	-
BorAX	-	-	-

<b>A</b> Coating	<b>B<sub>1</sub></b> Decoating time for 2 μm, ø 10 mm	<b>B<sub>2</sub></b> Decoating time for 2 μm, ø 80 x 180 mm	<b>C</b> Decoating recipe*	<b>D</b> Module
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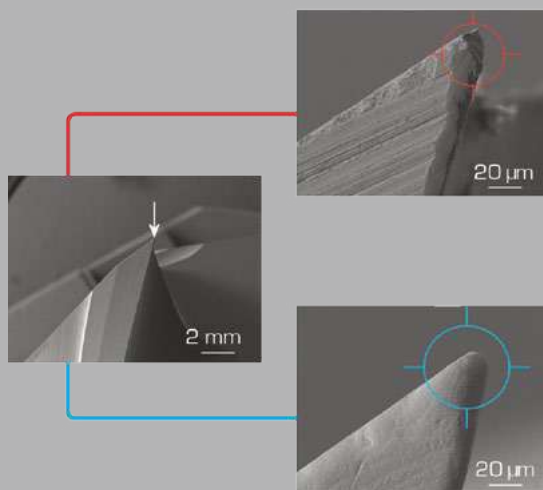
\* Decoating chemicals available through the worldwide distribution network of Borer AG, Zuchwil, Switzerland

# Edge pre-treatment

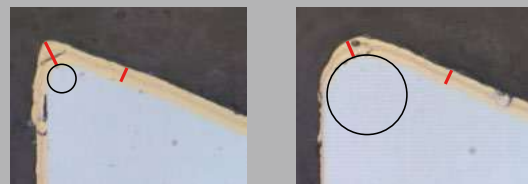
## OVERVIEW

The edge pre-treatment is a very important process in a turnkey system designed to utilize the full potential of a coating. The main aim of edge pre-treatment is to increase the edge's stability and thus the tool's performance.

Typical cutting-edge from a high-end tool manufacturer



Comparison



Advantages of cutting-edge rounding:

- Reduces chipping
- Reduces what is referred to as an “antenna effect” in PVD coatings on sharp edges and thus reduces the stress in the coating
- The more an edge is rounded, the thicker the coatings can be
- Higher cutting-edge stability
- Avoids cutting-edge breakouts and flaking of the coating during the machining process
- Increase of the tool's lifespan despite a “blunt” cutting-edge

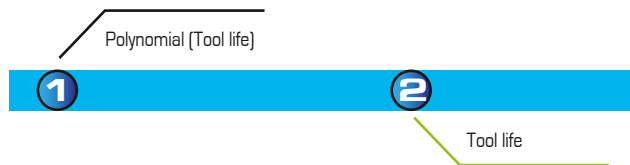
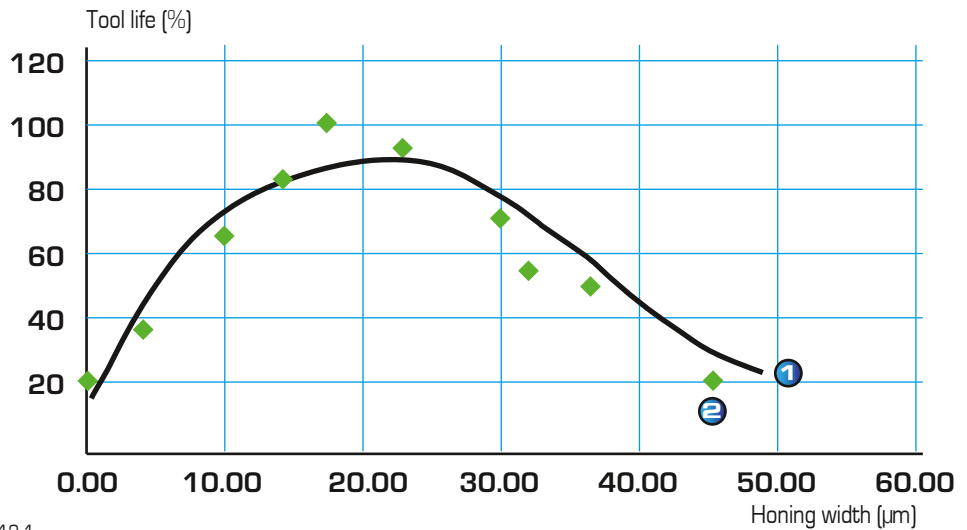
# Edge pre-treatment

## INFLUENCE OF CUTTING-EDGE ROUNDEDING

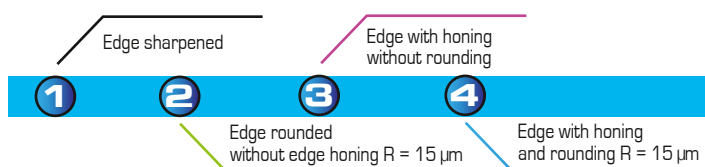
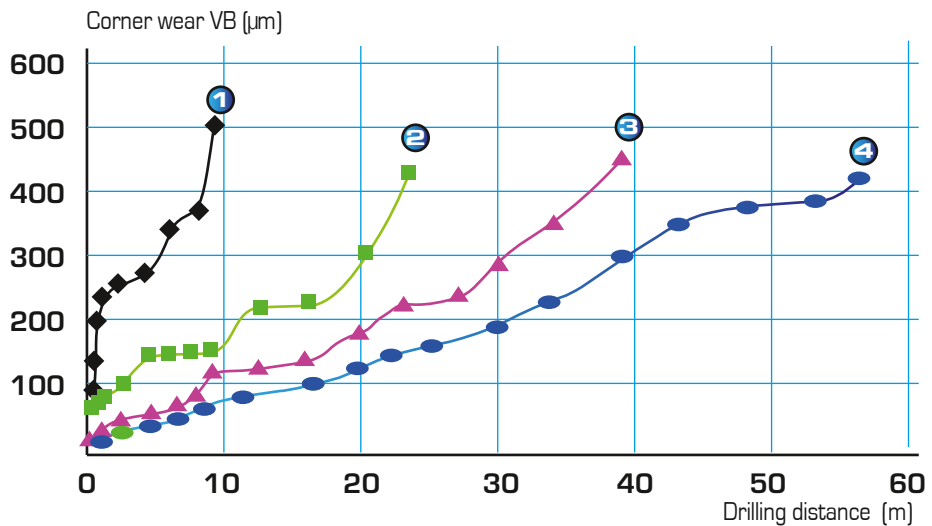
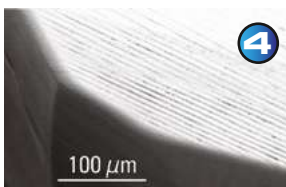
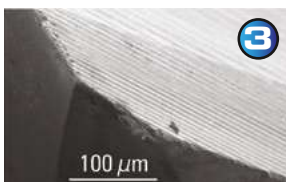
### Influence of cutting-edge rounding when milling high-alloy steel:



Tool: end mill, D10, z = 4  
 Workpiece material: 1.2379; X155CrVMo12-1  
 $a_p = 1.5 \times d$   
 $a_e = 0.25 \times d$   
 $v_c = 150 \text{ m/min}$   
 $f_z = 0.05 \text{ mm/z}$   
 Source: GFE, Germany  
 Coating: nACRo



### Influence of cutting-edge rounding when drilling:



Tool: blind holes, VHM drill, D5  
 Workpiece material: cold work steel; 1.2379; X155CrVMo12-1; HRC22  
 Dry air cooling  
 $a_p = 15 \text{ mm}$   
 $v_c = 75 \text{ m/min}$   
 $f_z = 0.15 \text{ mm/z}$   
 Coating: nACo



## METHODS FOR EDGE PRE-TREATMENT

Different materials and tools require different methods of edge pre-treatment. Below is an overview of the most common ones:

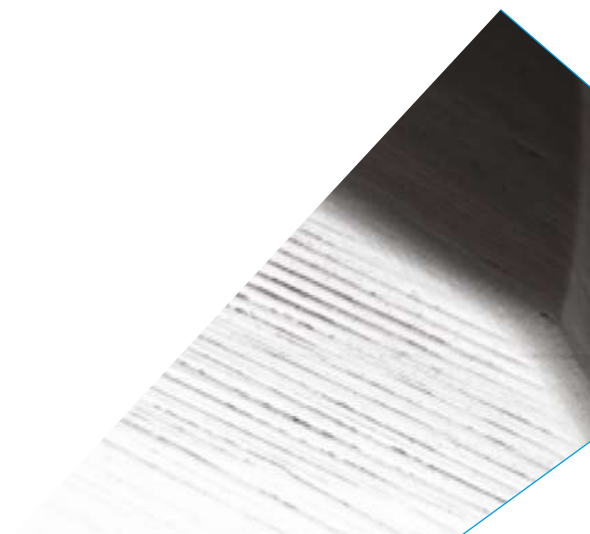
Method		Dry blasting	Wet blasting	Drag grinding	Brushing	Magnet finish
<b>Tool type</b>	Drills	+	++	++	+++	+++
	End mills	+	++	+++	+++	+++
	Inserts	++	+++	+	++	+
	Hobs	++	+++	+	+	-
	Punches	-	+++	+++	-	-
	Molds and dies	++	+++	-	-	-
<b>Characteristics</b>	Stability	+++	+++	+++	+++	+++
	Flexibility	+++	+++	++	++	++
	Productivity	+	+++	++	++	++
	Groove polishing possible	Limited	Yes	Yes	Yes	Limited
	Automation solutions possible	Yes	Yes	Yes	Yes	Yes
	Special characteristics	Blasting media sticks to the surface	Universally usable	Smooth surface	Individual treatment for cutting-edges and surfaces possible	Especially for micro-tools

+++ High quality and high efficiency

++ High quality or high efficiency

+ Low quality and/or low efficiency

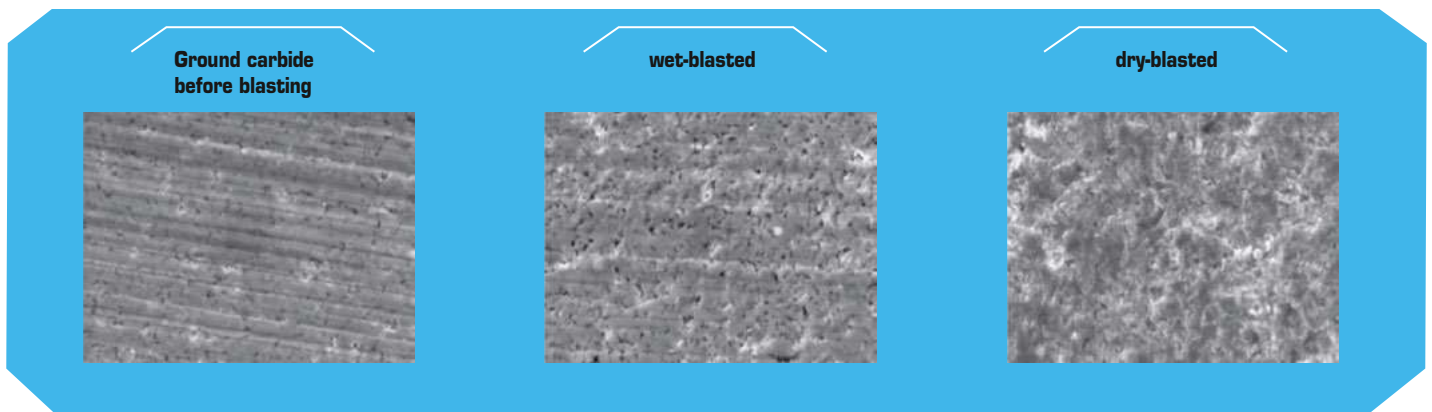
- Not suitable for the system



# Edge pre-treatment

## WET AND DRY BLASTING

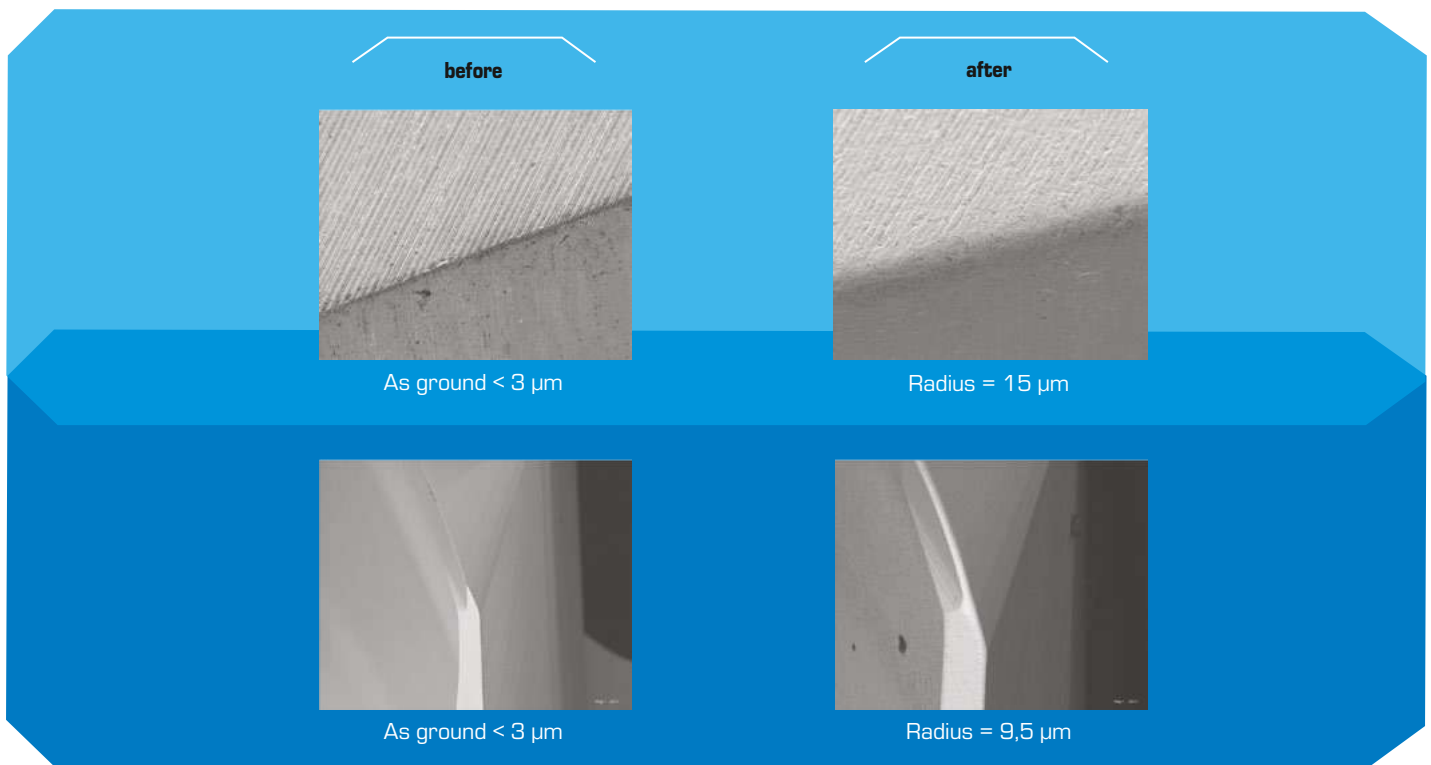
### Comparison of wet and dry blasting:



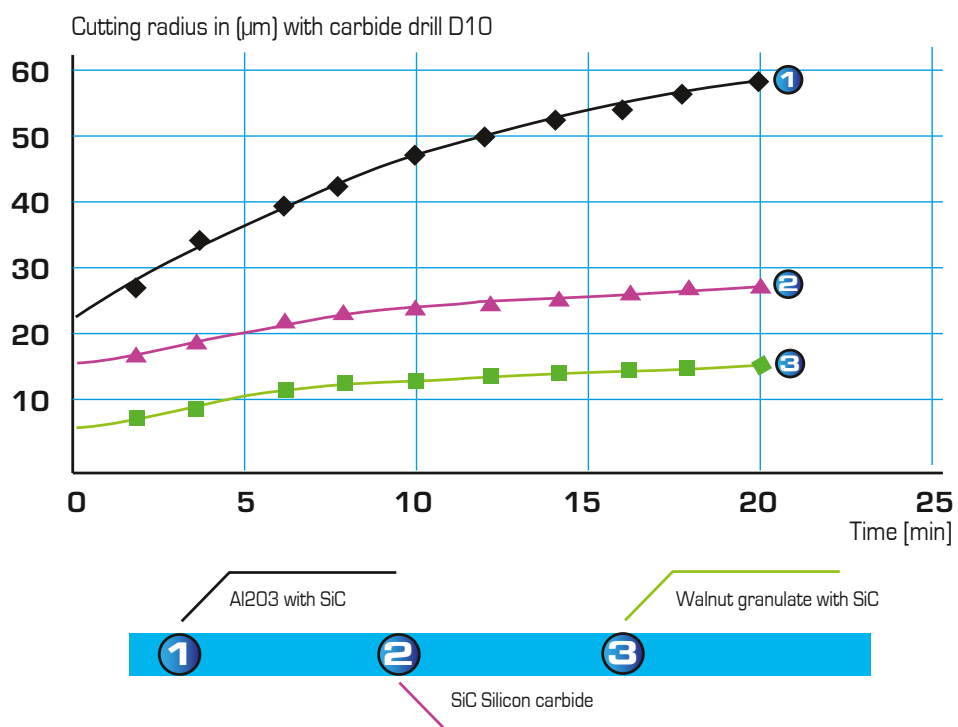
Comparison	Wet	Dry
Surface roughness	Sa = 0.05 µm; Sz = 0.32 µm Slightly shiny surface	Sa = 0.11 µm; Sz = 1.14 µm
Residual material after blasting	Risk of cobalt leaching due to the water	Smearing of the residual material
Coating adhesion	HF1	HF1 - HF3
Edge rounding	Good to control	Difficult to control
Grain size	Mesh 320 (50 µm), coarse, for edge rounding Mesh 400 (37 µm), medium, for surface activation Mesh 500 (30 µm), fine, for polishing	
Typical micro-blasting time [min] for hobs ø 80 mm; R = 10 µm	3	6
Advantages and disadvantages	<ul style="list-style-type: none"> <li>• Pre-cleaning not necessary</li> <li>• Drying needed after blasting</li> <li>• Difficult to clean after interruption</li> <li>• Fewer abrasive inclusions in the tool surface</li> <li>• High productivity</li> <li>• Low surface roughness at the same edge rounding</li> </ul>	<ul style="list-style-type: none"> <li>• Pre-cleaning necessary</li> <li>• No need for drying after blasting</li> <li>• Easy handling even after interruption</li> <li>• More abrasive inclusions in the tool surface</li> <li>• Deburring without damaging the cutting-edge</li> <li>• Activation of the surface with the option to coat immediately afterwards</li> </ul>

## DRAG GRINDING

Cutting-edge rounding and surface quality before and after the drag grinding process:



Depending on the required edge rounding, different media are applied.



## OVERVIEW

A clean metallic surface is necessary for coating. Contamination such as grinding residue, oil or dust weaken the coating's adhesion.

The industrial single-chamber cleaning units from PLATIT are the result of a partnership with Eurocold:

- Chamber sizes adapted to coating units by PLATIT
- Fully automatic cleaning process including vacuum drying
- Intuitive touch screen with real-time process parameters
- Remote diagnosis and maintenance
- Independent of environmental conditions as the system is closed

PLATIT offers two different standard sizes of single-chamber cleaning units, which can be tailored to individual customer needs on request, e.g. in terms of:

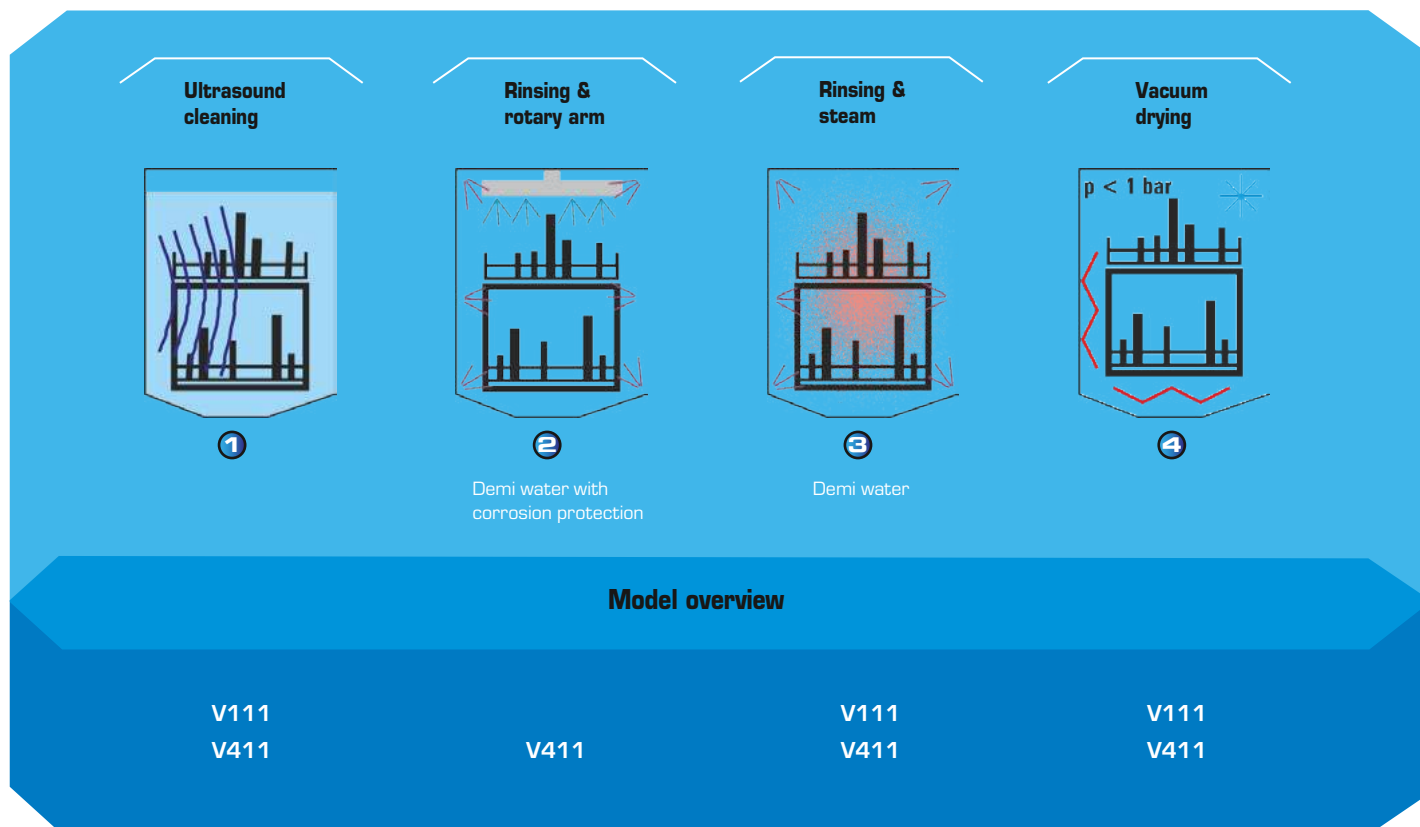
- Number of cleaning baths
- Bath filtration
- Immersion rinsing



Cleaning unit	V111	V411
Chamber volume [mm]	W 350 x D 390 x H 480	W 500 x D 500 x H 500
Loading for shank tools ø 10 x 70 [mm]	504 pcs.	1008 pcs.
Max. load [kg]	150	200
Cycle times [min]	Approx. 45	Approx. 45

## CLEANING PROCESS

Cleaning cycle:



Advantages of a single-chamber cleaning unit compared to a cleaning line:

	Single-chamber cleaning unit	Cleaning line
<b>Footprint</b>	Compact	Very big (long)
<b>Sensitive to environment</b>	No	Yes (lower with housing)
<b>Evaporation</b>	No	Yes
<b>Ventilation necessary</b>	No	Yes
<b>Controlled atmosphere</b>	Yes	Limited
<b>Throughput</b> (with the same bath size)	Low	High
<b>Detergent selection</b>	Limited	Full flexibility
<b>Detergent carry-over</b>	No	Yes
<b>Oscillation</b>	No	Yes
<b>Heavy tools</b>	Easy handling	Depends on crane
<b>Investment</b>	Medium	High
<b>Energy consumption</b>	Medium	High

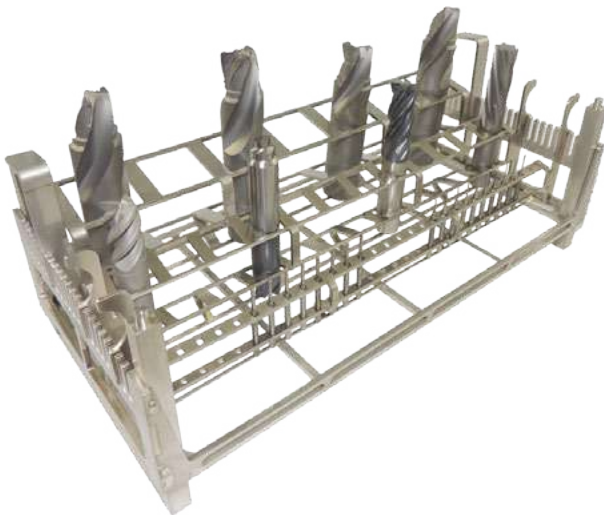
## CLEX® – MODULAR HOLDER SYSTEM

### CleX® for shank tools

Flexible holders for the cleaning and decoating of shank tools.

Advantages:

- Tools of different diameters can be cleaned and decoated together
- Up to 150 % more tools compared to conventional systems
- CleX® carrier can be handled with loaded tools
- CleX® baskets are stackable
- Lightweight construction – low shadowing
- Minor contact surfaces – no washing stains
- Inclined surfaces – good water drainage
- Stainless-steel construction – high temperature resistance and long service life



Cleaning unit		V111	V411
CleX® frame		4 baskets	8 baskets
CleX® carrier	Shank diameter (mm)	Tool/CleX®	Tool/CleX®
CleX® S3	3	30	210
CleX® S5	5	26	182
CleX® S6	6	24	168
CleX® S8	8	20	140
CleX® S10	10	18	108
CleX® S12	12	16	96
CleX® S14	14	15	60
CleX® S16	16	13	52
CleX® S18	18	12	48
CleX® S20	20	11	44
CleX® S25	25	9	27
CleX® S32	32	7	21



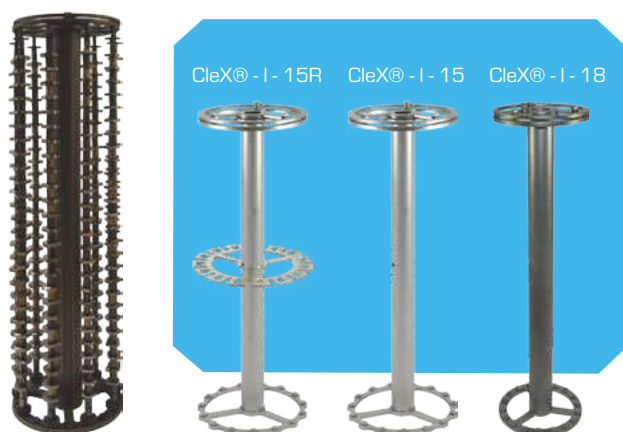
## HOLDER SYSTEM CLEAN FLEXIBLE FOR CLEANING AND DECOATING

### CleX® for inserts

Flexible holders for inserts for minimal handling during pre-treatment, post-treatment and coating. Without reloading, up to 500 different inserts can pass through the following sequence of processes at the same time:

- Edge pre-treatment by wet or dry blasting
- Cleaning
- Coating
- Post-treatment by wet or dry blasting

With wet and dry blasting, all sides of the inserts are treated. Especially suitable for inserts with holes.



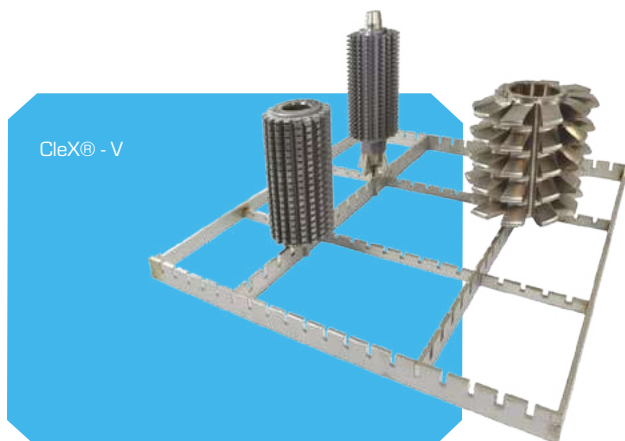
	Optimized for edge length □ [mm]	Insert hole min. diameter [mm]
CleX® for inserts with 15 pos. and support ring	14	2.4
CleX® for inserts with 15 pos.	14	3.7
		4.2
		5.2
CleX® for inserts with 18 pos.	18 x 8.5	3.7
	9 x 19.0	4.2
	6 x 29.4	5.2
		6.2

### CleX® for hobs and cutting wheels

Flexible holders for the cleaning and decoating of hobs and cutting wheels.

Advantages:

- Hobs and cutting wheels with different diameters and lengths can be cleaned together
- Stainless-steel construction with high temperature resistance and long service life



Hob with a hole	Diameter of a hole [mm]
CleX® V-HB L80	> 14
CleX® V-HB L160	> 14
Hob with a shank	Diameter of a shank [mm]
CleX® V-HS 32	32
CleX® V-HS X	Individual
Cutting wheel	Outer diameter [mm]
CleX® V-G	≤ 200

## OVERVIEW

Thickness and adhesion are important characteristics of a coating. They need to be controlled and monitored to guarantee a constant level of performance.

### PQCS\_PLATIT Quality Control Software

PQCS is a quality control software developed by PLATIT. The software is optimized for easy and fast data acquisition by recording batch photos, coating thickness and adhesion. All data is stored in a database to generate a coating report and provide a graphical representation of quality trends.



Advantages:

- Simple user interface
- Generating a coating report step by step to record the coating quality
- Automatic database entries including customer information, batch information and a photo, calo and Rockwell image
- User-defined fields can be integrated
- The data can be filtered and represented graphically to recognize quality trends

### Methods for quality control

The basic quality control methods of a PVD coating are::

- Coating thickness measurement using a calo tester on test plates and tools
- Adhesion evaluation using a Rockwell or scratch tester

Products and integration services available from PLATIT.

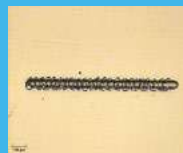
Calo test



Rockwell test



Scratch test



**PLATIT®** Pavoni Tools

**Coating Report**

Name:	Order Code:	Report no.:	02
Date of measurement:	7/23/12		
Coating unit:	20771 000		
Batch no.:	12 07 20-03-08	Customer:	Fluor-Tech
Measured substrate:	240404	Contact:	John Taylor
Coating material:	1402	Order confirmation number:	48702204
Coating:	1402		

Coat parameters:	1402MAX	Hardness:	Rockwell C
Coating time:	20 min	Before coating:	65.4 HRC
Coating speed:	400 mm/s	After coating:	65.3 HRC
Control diameter:	30 mm		
Obtained adhesion quality:	0.93 µm		

Obtaining image:  

Rockwell indentation: 

Thickness total: **2.04 µm**      Adhesion class: **HF1**

HF1   
  HF2   
  HF3   
  HF4   
  HF5   
  HF6   
  Not applicable

Comments:

---

Signature: \_\_\_\_\_

Quality Control System Description  
Measurement system with multi-angle microscope and measurement software module. Reference control bar according to "W40-101" Part 2".  
Reference standard according to standard DIN EN ISO 6503 (Rockwell). Adhesion control bar according to ISO 6503, paragraph 3.3. Reference hardness = 65HRC. Coating thickness = 3 µm.

Page 1 of 1

Coating report



## OVERVIEW

### Objectives of post-treatment:

- Removal of droplets after coating
- Reduction of surface roughness
- Improved chip flow

One of the problems that can arise without post-treatment of the surfaces is the jamming of the chips, which can cause a tool such as a drill to break.

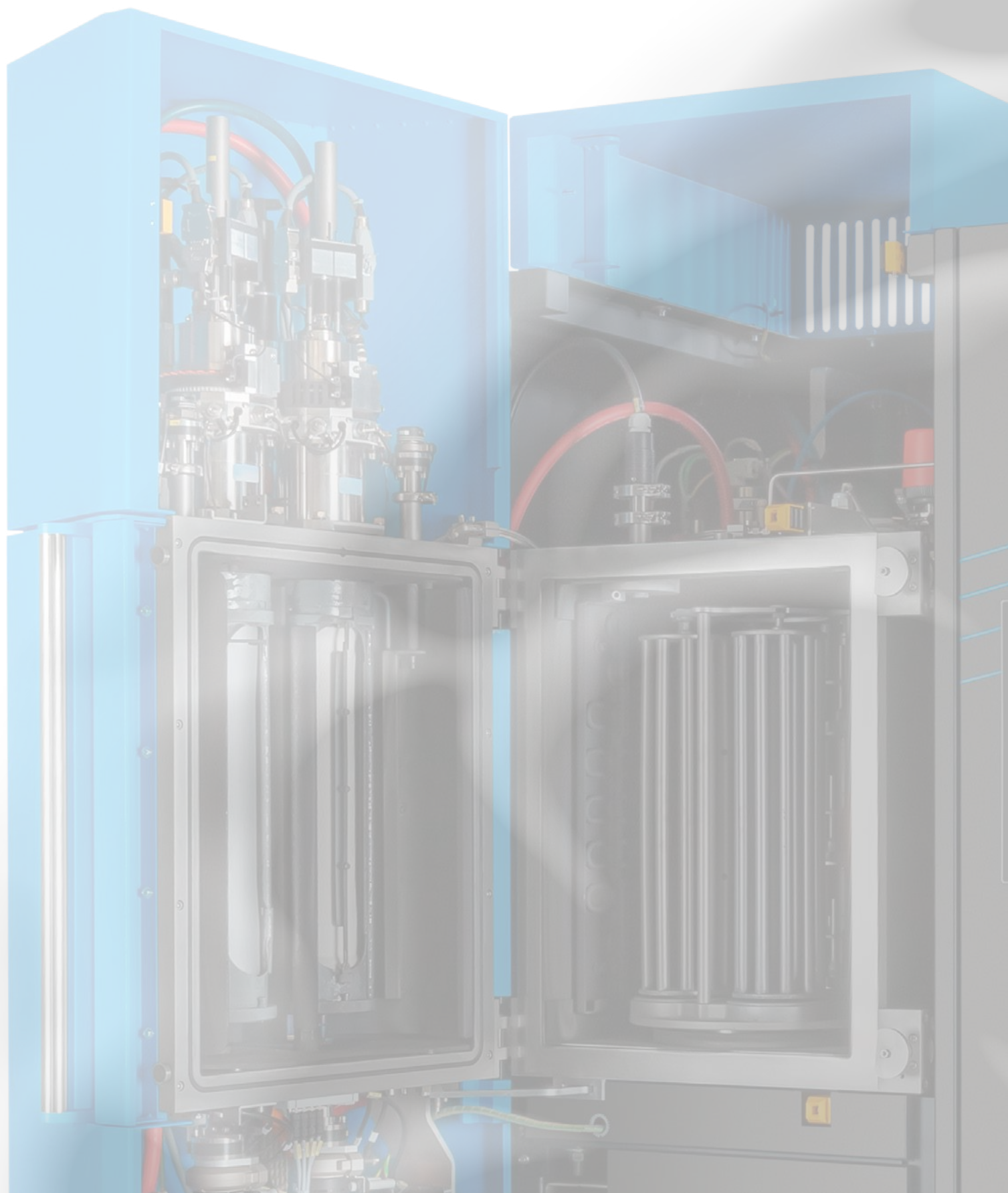
### Overview of the most common post-treatment methods:

Method		Wet blasting	Drag grinding	Polishing
<b>Tool type</b>	Drills	+++	++	+++
	End mills	+++	+++	+++
	Inserts	+++	+	+
	Hobs	+++	+	-
	Punches	+++	+++	+++
	Molds and dies	++	-	+++
<b>Characteristics</b>	Stability	+++	+++	-
	Flexibility	++	+	+++
	Productivity	+++	++	+
	Groove polishing possible	+	++	+++
	Droplet removal possible	+	++	+++
	Automation solutions possible	Yes	Yes	No
	Special characteristics	Universally usable	Smooth surface	Very smooth surface

- +++ High quality and high efficiency
- ++ High quality or high efficiency
- + Low quality and/or low efficiency
- Not suitable for the system

If the post-treatment is too intense, the edge will become exposed. This will lead to:

- Immediate full and direct contact of the cutting-edge with the workpiece material
- Low thermal and chemical insulation
- Low coating thickness near the cutting-edge
- A larger cutting-edge radius, which results in a larger surface area without coating
- The impression of a defective coating





## PLATIT COATING INTELLIGENCE

- PREMIUM PLUS PACKAGE
- CATHODE EXCHANGE



PLATIT® **11** - Series

## OVERVIEW

PLATIT's lifecycle management strategy is focused on customer expectations and high-quality support.

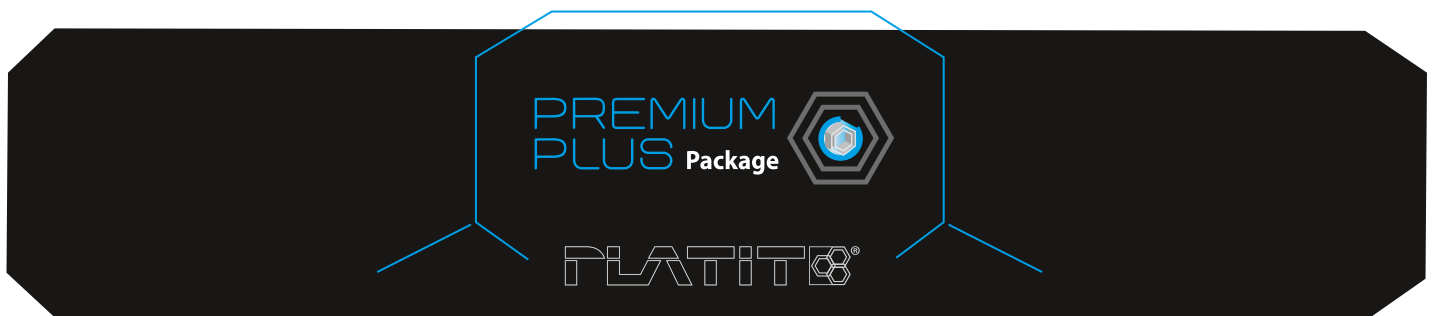
After a PLATIT coating unit has been sold, that information will be entered into an online service database and the access information will be sent to the customer. In the online service database, customers can find information on spare parts, drawings, the service history and service status of their machine as well as contact information for their technical advisor to make targeted problem-solving possible.

PLATIT serves customers around the world in all time zones. The central warehouses in the Czech Republic, Switzerland, the United States and China guarantee short delivery times and short supply routes for spare parts. The service teams at these locations ensure first-level support and can be reached via the hotline.

Over the lifetime of a PLATIT PVD coating unit, the following service products will be offered:

- Cathode exchange
- Premium Plus Package with additional service options
- Daily service through hotline support
- Remote access with augmented reality
- Process support according to the application
- Standard and customer-specific training programs on request at the customer's or PLATIT's site

### Premium Plus Package\_Worldwide



PLATIT offers its customers a Premium Plus Package with the aim of increasing OEE (overall equipment efficiency). Over the duration of the contract, this includes:

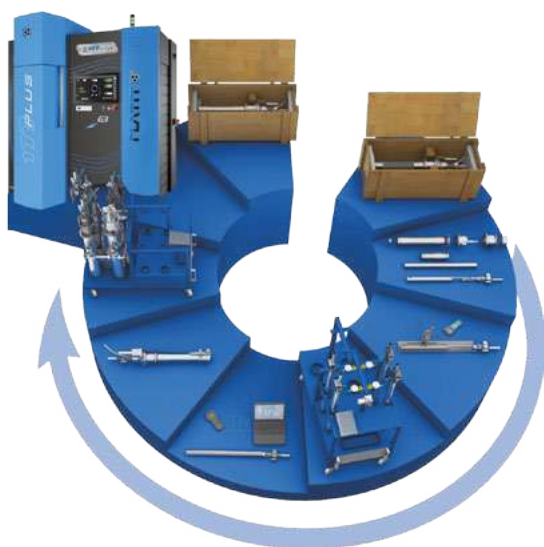
- Execution of preventive maintenance services according to a predetermined schedule
- Daily support via hotline and internet

The Premium Plus Package guarantees maximum uptime of the coating system, reduced maintenance costs and improved performance at a consistent coating quality.

## CATHODE EXCHANGE

Exchanging cathodes has been made very easy for PLATIT customers. To avoid storage costs for them, PLATIT takes care of transporting the new cathodes and recycling the target material in an environmentally friendly manner. PLATIT guarantees the exchange and quality of the target and will provide customers with information on how the cathode exchange can be carried out quickly.

### Process of cathode exchange



1. The customer reports the need for cathode exchange
2. PLATIT ships the new cathode to the customer within 24 hours
3. After receiving the new cathode, the customer returns the old one
4. Receipt of the old, used cathode at PLATIT
5. Disassembly of the cathode, recycling of the target
6. Replacement of all wearing parts to refurbish the cathode
7. Checking of the mechanical functions, adjustment of the magnetic field and installing of a new target
8. After long-term vacuum testing, examination of the cathode under industrial production conditions
9. The cathode is reused only when optimum burn-in can be guaranteed

PLATIT has service organizations in Europe, North America and Asia with 4 Cathode Exchange Centers (CEC) worldwide:

Libertyville, US

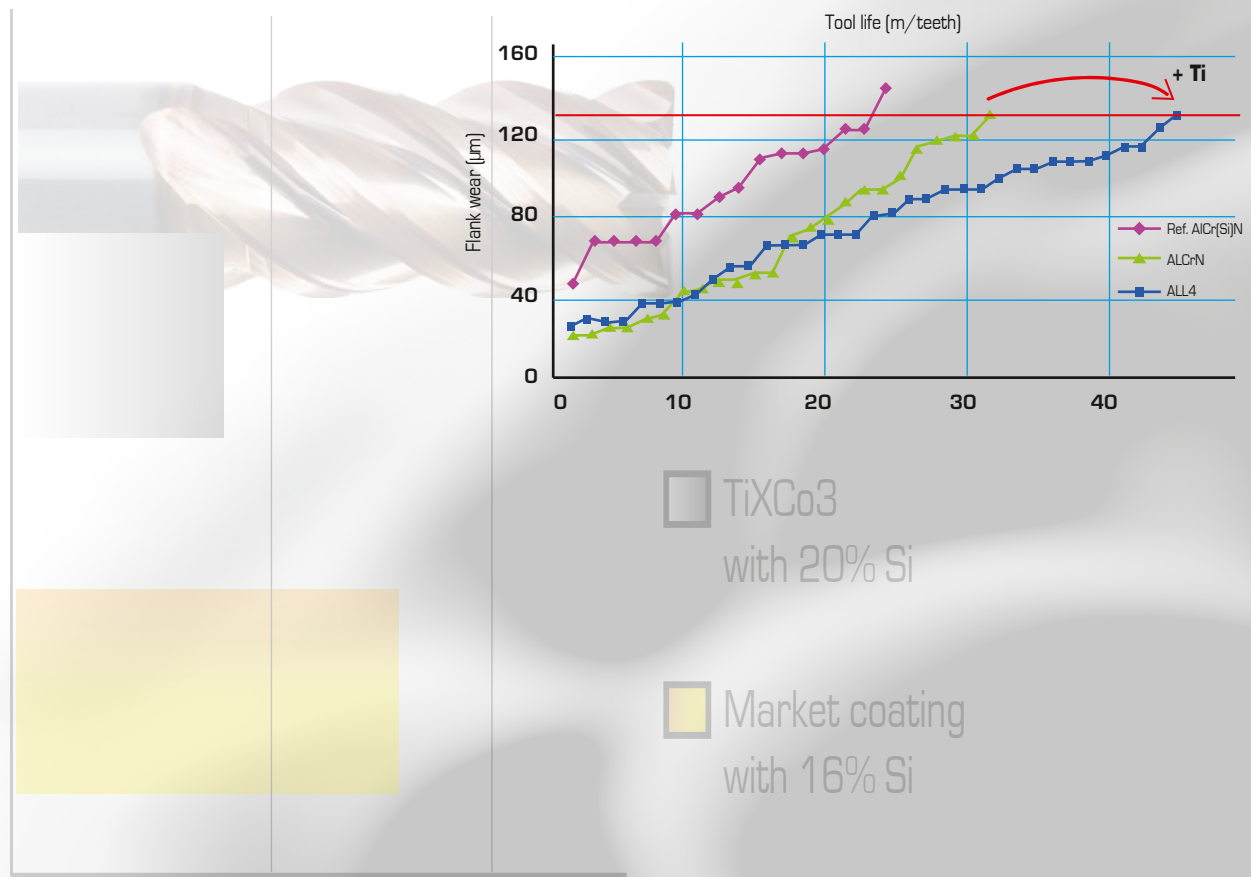
Šumperk, Czech Republic

Seoul, South Korea

Shanghai, China

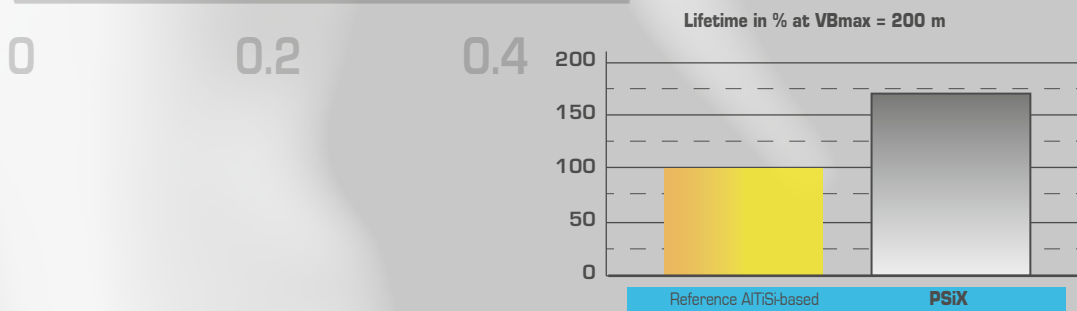


## Wear Vb [µm]



 TiXCo<sub>3</sub>  
with 20% Si

 Market coating  
with 16% Si





## PLATIT COATING INTELLIGENCE

- IN-HOUSE PLATIT UNITS
- PLATIT UNITS FOR COATING CENTERS

PLATIT® *11* - Series

## OVERVIEW

The coating units from PLATIT are ideally suited for a seamless integration into the tool manufacturing and regrinding process. For coating centers, PLATIT provides coating units which meet the various challenges of their customers. Furthermore, at PLATIT's CCS division Custom Coating Solutions are designed and built according to the customer requirements.

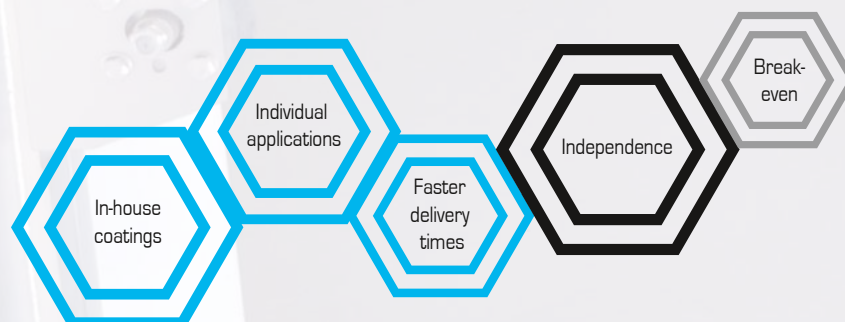
### In-house PLATIT units for tool manufacturers and regrinders

The integration of coating units into the in-house tool manufacturing or regrinding process offers a variety of advantages:

- **Independence:** with your own turnkey system, the entire production is in your own hands.
- **Faster delivery times:** in-house processes are more environmentally friendly, ensure the shortest possible routes and prevent transport damage. Production, grinding and coating can take place on the same day.
- **Coating know-how for individual applications:** a coating center mixes different tools; processes are designed for general use, not specifically for individual applications. With an integrated coating process, coating quality can be considered for specific applications. PLATIT has a broad portfolio of coatings that can be adapted to a variety of applications.
- **In-house coatings:** PLATIT's open-source technology, which makes it possible for customers to develop their own coatings, guarantees the potential for differentiation from the competition.
- **Break-even:** an integrated coating center usually pays off in less than two years. In-house coating does not require more employees than are necessary to handle the logistical tasks associated with using a job coater. The costs of operating a PVD coating unit can quickly be lower than the costs of outsourcing PVD coating.

Especially tool manufacturers with a high demand for the latest technologies and innovative PVD coatings benefit from the properties of PLATIT's Pi technology in terms of a unique competitive advantage.

For the calculation of an investment in a PVD coating system it is to be noted that the majority of the costs of a PVD system per batch are influenced by the fixed costs. The main cost drivers are personnel, financing and rental costs. The pure operating costs on the other hand often amount to less than a quarter of the total costs. The target costs develop positively with an increasing tool capacity, so that the costs get reduced by half.





## IN-HOUSE PLATIT UNITS IN ACTION



## OVERVIEW

### PLATIT coating units for coating centers

Coating centers have different demands regarding a PVD coating system than tool manufacturers or regrinders. Example requirements are listed below:

- **Flexibility:** PLATIT standard and custom coating solutions can be programmed with different coating structures. The systems can deposit PVD and PECVD for various nitride, oxide and DLC coatings.
- **High-quality coatings:** in depositing coatings, PLATIT units combine high performance with very short cycle times.
- **Partnerships:** PLATIT attaches great importance to strategic partnerships, as both parties benefit from sharing knowledge, and therefore supports coating centers from sampling to the adaptation of coatings. With worldwide service, support and sales offices as well as a network for upstream and downstream processes, PLATIT always stands by its customers.
- **Customer acquisition:** as a premium supplier, PLATIT assists coating centers in customer acquisition and brings together supply and demand.
- **No competition:** to PLATIT, it is very important that there is no competition with its own customers. For this reason, it has not set up any coating centers in its target markets since PLATIT AG was founded.

### Strengths of PL1011 and Pi1511:

PLATIT offers two different series of standard coating units. Customers with a strong focus on innovation and technology use the mix of planar and round cathodes in the Pi1511 to generate an exceptional performance advantage with the unique cathode configuration. The PL1011 enables coating centers to meet the high-quality demands of their customers. The planar targets, which are considered standard on the market, guarantee a cost-efficient coating.

#### PL1011:

- Four Planar ARC cathodes, considered standard in the PVD world
- Low costs per tool
- For coating large quantities of different tools
- Suitable for a wide range of application

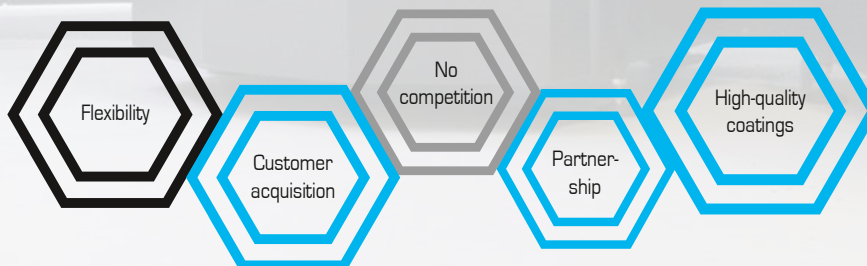
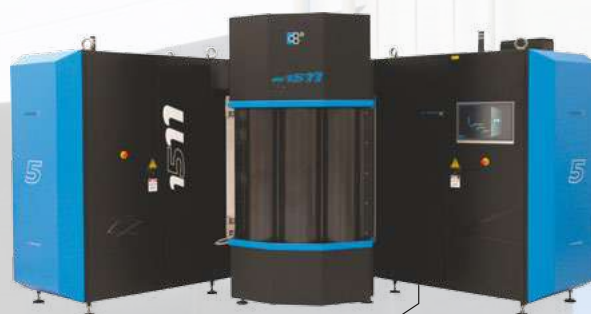
#### Pi1511:

- Uniquely flexible cathode composition with three rotating and two planar ARC cathodes for exclusive performance benefits
- Fast cathode exchange and long lifetime of the LARC® XL cathodes (Lateral Rotating XL Cathode)
- MAC-3C (Magnetic ARC Confinement - Coil Current Compensation) for automated magnetic field adjustment to increase the lifetime of a target
- Possibility to develop in-house coatings
- User-friendly and intuitive software that meets the latest standards
- Focused on specific applications in Industry 4.0

## PLATIT UNITS IN ACTION IN A COATING CENTER



**LISS**  
A company of **BCI**



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