TURNKEY SOLUTIONS

The TKS concept

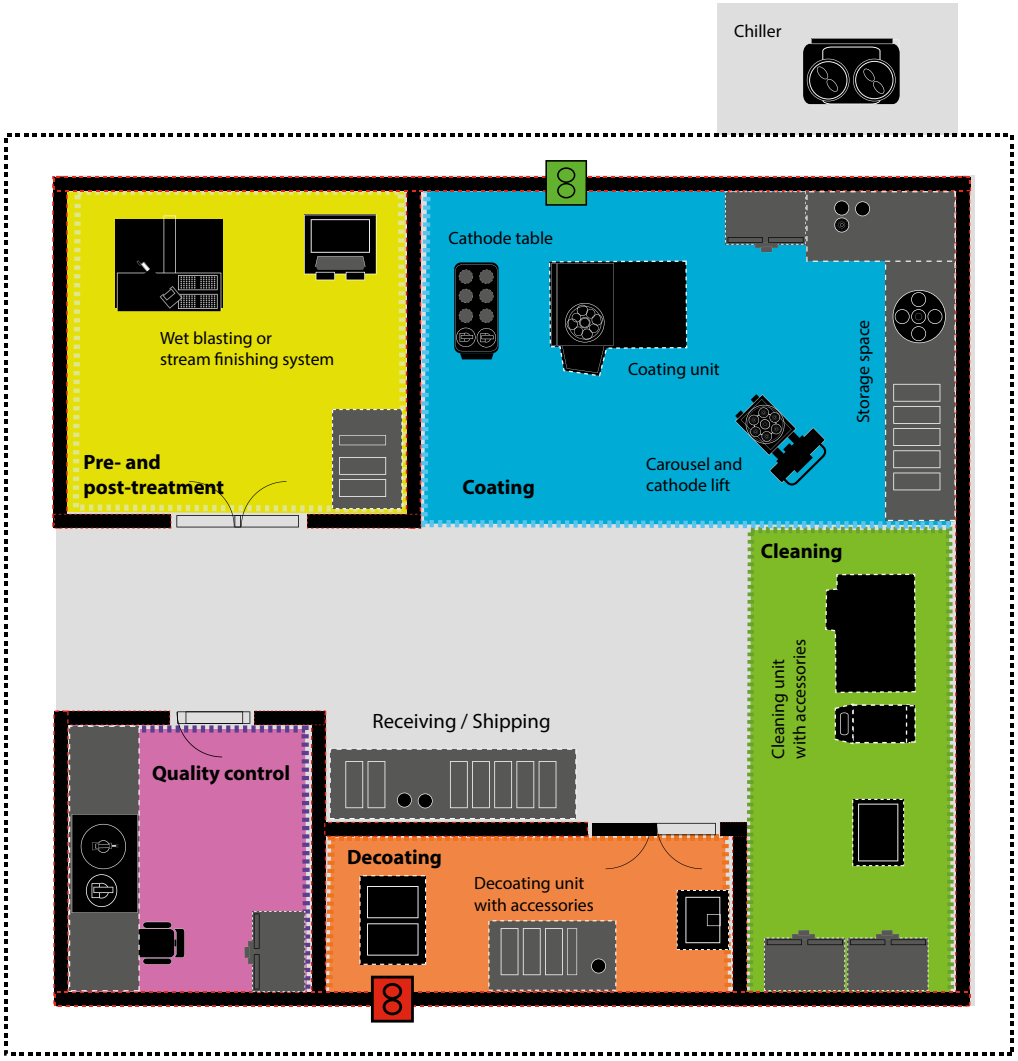
PLATIT's turnkey system with complete solutions for upstream and downstream steps for hard coating is ideally suited for seamless integration into the tool manufacturing and regrinding process. As a partner for its customers, PLATIT takes responsibility for the functionality of the whole system.

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

The TKS concept

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

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

Decoating

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.

Conventional process

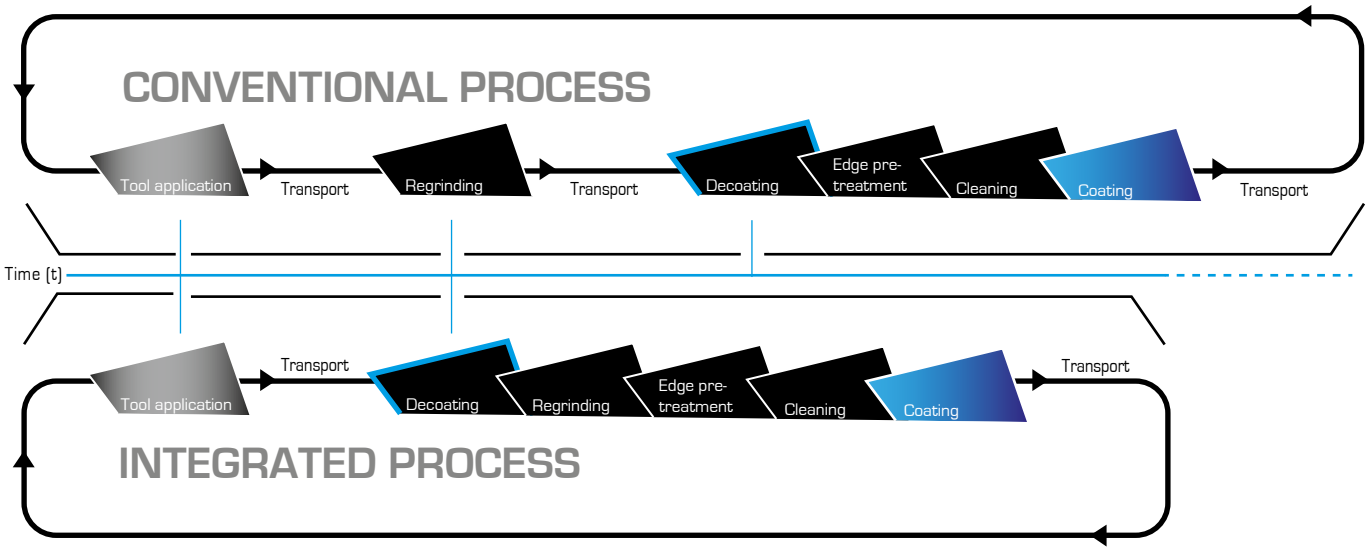
In coating centers, tools are usually decoated after regrinding. However, decoating after regrinding can damage the final geometry of the tool and increase the risk of poor adhesion. In addition, packaging, transport and repackaging involve the risk of damaging the tool.

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

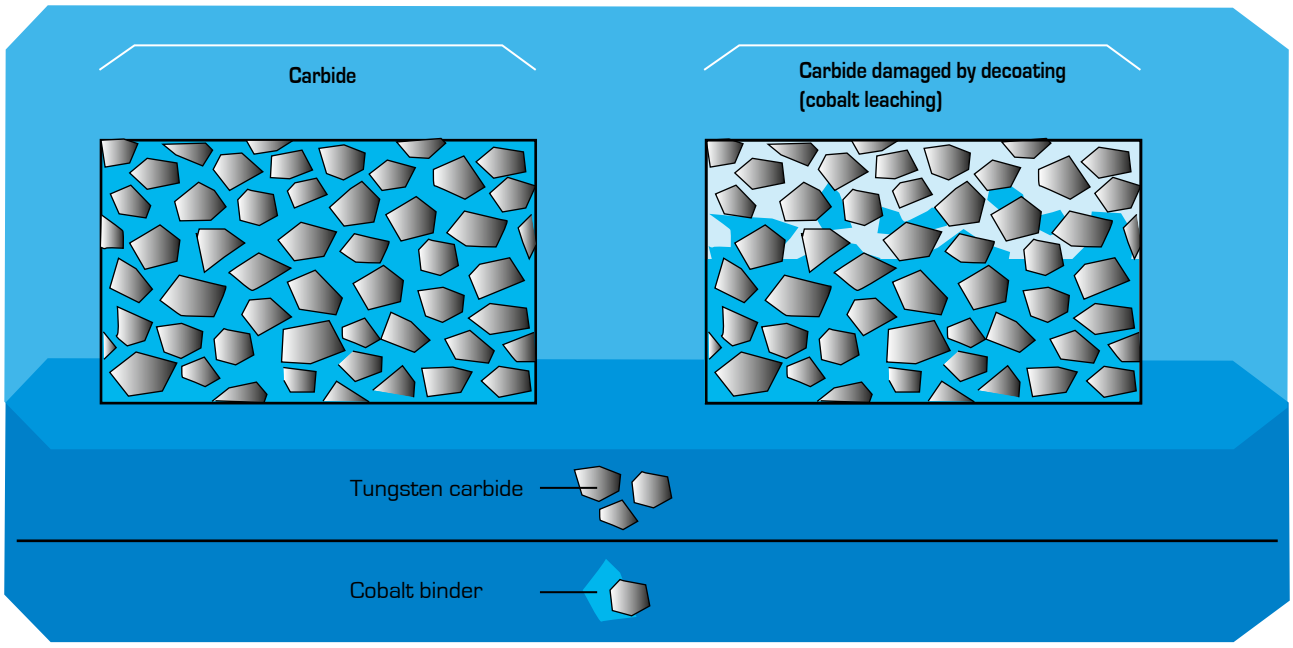


In decoating carbide, the biggest challenge is to avoid damaging the substrates. The most common damage is caused by cobalt leaching.

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_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

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.

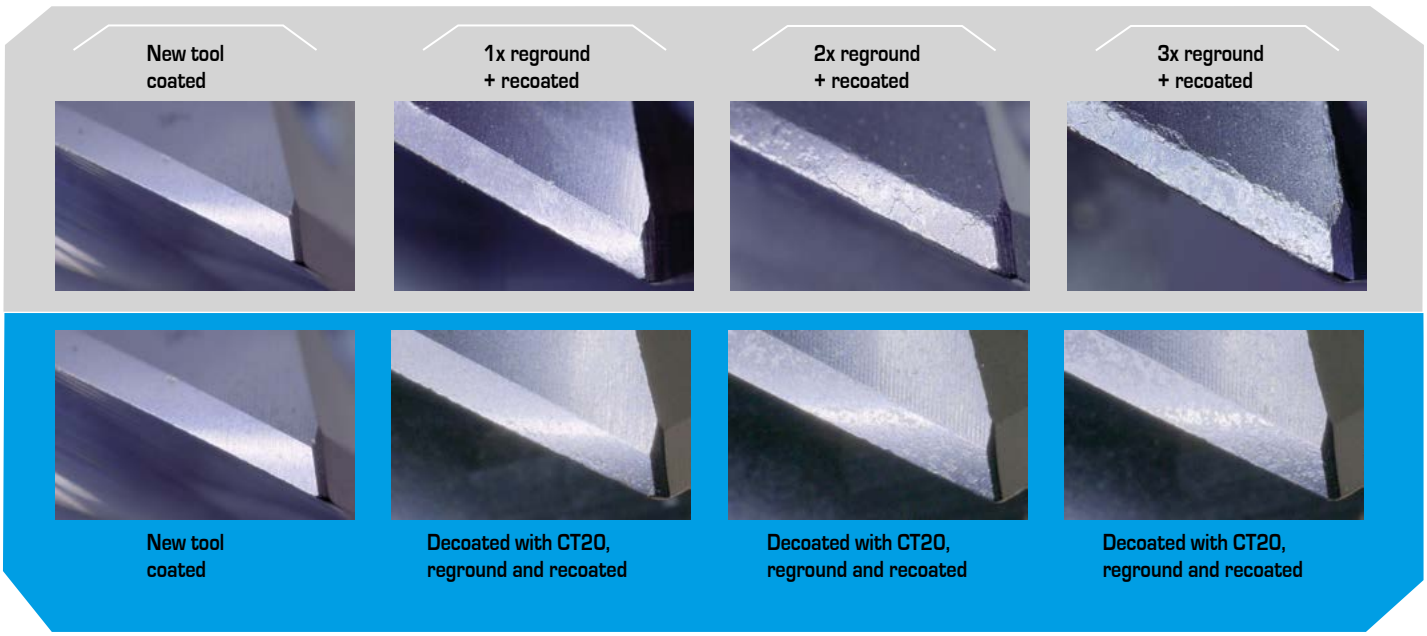
The end of the process is automatically detected by built-in electronics. The adhesion layer is not removed and therefore "overcoated" after regrinding and pretreatment. A service life comparable to that of a new tool is achieved.

Features:

- The new environmentally friendly wet chemical carbide decoating unit from PLATIT
- Fastest decoating process worldwide
- Decoating time is less than 3 minutes all the way to the TiN adhesion layer and the decoating cycle stops automatically at the TiN adhesion layer
- A single recipe for a wide variety of nitride coatings with a TiN adhesion layer, independent of tool size
- Multiple coatings can be removed as well
- Special holders for shank tools, hobs, inserts etc. to avoid attacking uncoated areas
- Max. tool dimensions: ø 200 × 250 mm
- Common chemicals available worldwide
- 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	
TiN	N	N	N	N	
TiCN	N	N		N	
TiAlN	Y	Y		Y	3 min*
TiAlCN		Y		Y	3 min*
AlTiN	Y	Y		OPT	3 min*
CrN	OPT	OPT	N	OPT	2 min*
CrTiN	Y	Y		Y	3 min*
TapCT		Y			3 min*
ZrN	Y	Y		Y	2 min*
AlCrN		OPT			2 min*
Omnis		N		N	2 min*
AlTiCrN	Y	Y		N	3 min*
nACo	Y	Y		N	3 min*
nACRo	N	OPT			3 min*
TiXCo3	N	Y		N	3 min*
TiXCo4		Y			3 min*
PSiX		N		N	3 min*
BorAC		OPT			2 min*
TiBor		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 if TiN adhesion layer is applied
Empty = no standard recipe for the coating unit available



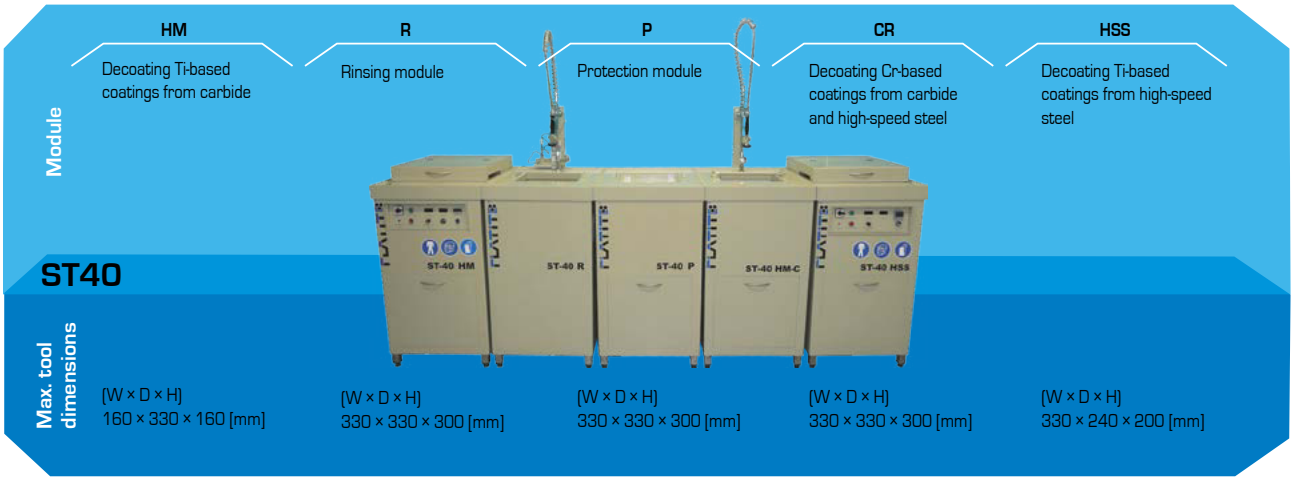
Without decoating, roughness increases and tool life decreases
Roughness and tool life remain constant, if the tool gets decoated with PLATIT CT20 before regrinding

Decoating

PLATIT ST40_Conventional decoating units

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:

Coating	A1	B	C
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	-	-	-
TapCT	-	-	-
ZrN	-	-	-
AlCrN	0.5–2 h	C	CR
Omnis	1–2 h	T-HM	HM
AlTiCrN	-	-	-
nACo	9–11 h	T-HM	HM
nACRo	0.5–2 h	C	CR
TiXCo3	5–9 h	T-HM	HM
TiXCo4	-	-	-
PSiX	10–18 h	T-HM	HM
BorAC	-	-	-
TiBor	1–2 h	T-HM	HM

ST40_High-speed steel hobs:

Coating	A2	B	C
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	-	-	-
TapCT	-	-	-
ZrN	-	-	-
AlCrN	0.5–2 h	C	CR
Omnis	1–2 h	T-HSS	HSS
AlTiCrN	-	-	-
nACo	0.5–2 h	T-HSS	HSS
nACRo	0.5–2 h	C	CR
TiXCo3	1–3 h	T-HSS	HSS
TiXCo4	-	-	-
PSiX	1–2 h	T-HSS	HSS
BorAC	-	-	-
TiBor	1–2 h	T-HS	HSS

A1 Decoating time for 2 µm, ø 10 mm

A2 Decoating time for 2 µm, ø 80 x 180 mm

B Decoating recipe*

C Module

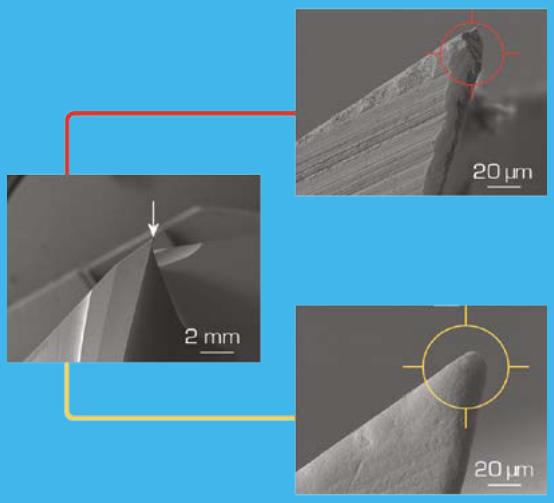
* Different decoating chemicals available through the worldwide distribution network of Borer AG, Zuchwil, Switzerland
- = cannot be decoated in conventional decoating units

Edge pre-treatment

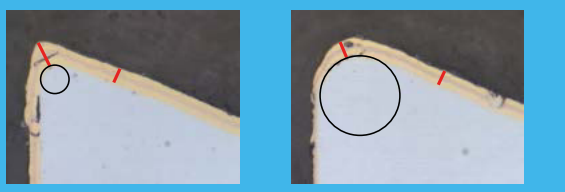
The edge pre-treatment is a very important process in a turnkey system designed to utilize the full potential of a coating.

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

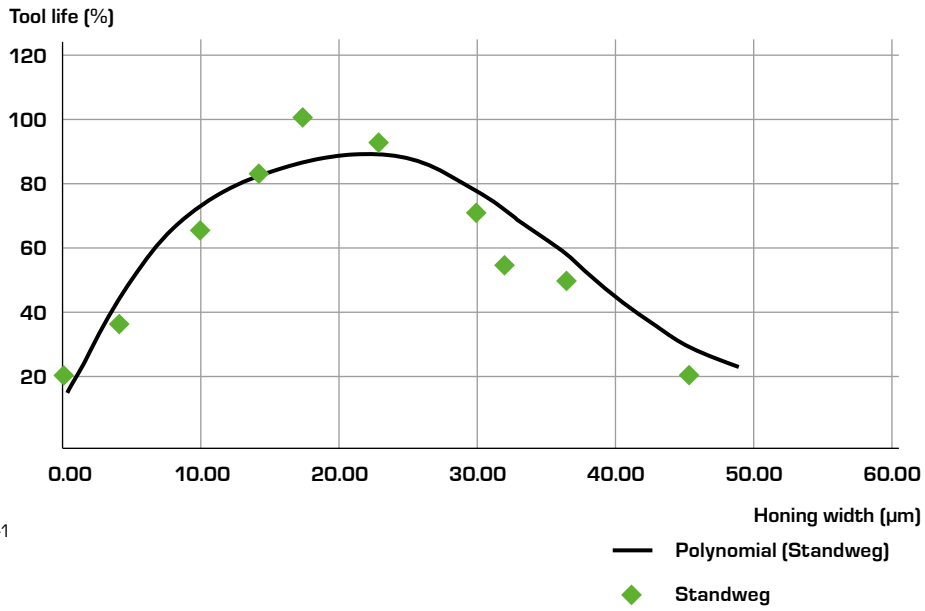


Advantages of cutting-edge rounding:

- 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

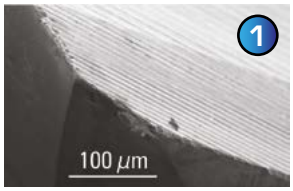
Edge pre-treatment

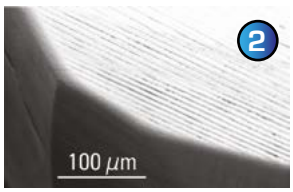
Influence of cutting-edge rounding when milling high-alloy steel

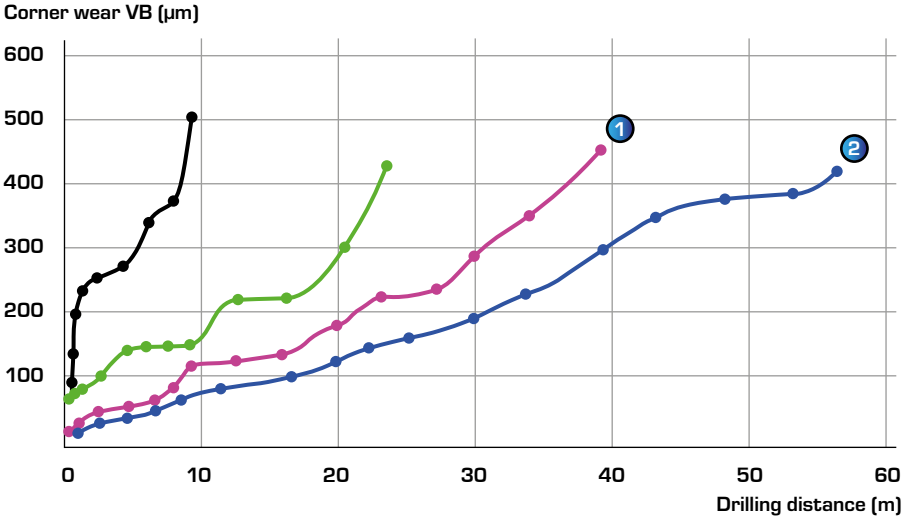


Tool: end mill, D10, z = 4
Workpiece material: 1.2379; X155CrVMo12-1
ap = 1.5 × d
ae = 0.25 × d
vc = 150 m / min
fz = 0.05 mm / z
Source: GFE, Germany
Coating: nACRo

Influence of cutting-edge rounding when drilling







Tool: blind holes; VHM drill; D5
Workpiece material: cold work steel; 1.2379; X155CrVMo12-1; HRC22
Cooling: dry air
ap = 15 mm
vc = 75 m / min
fz = 0.15 mm / z
Coating: nACo

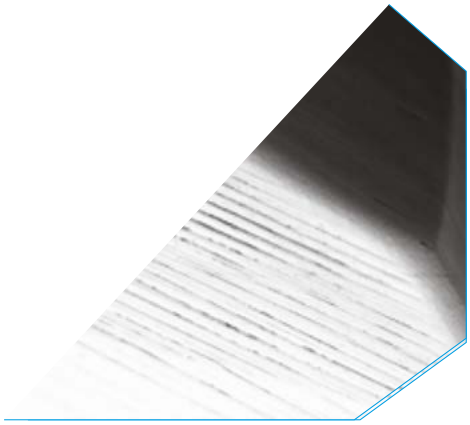
Edge sharpened
Edge rounded without edge honing R = 15 µm
Edge with honing without rounding
Edge with honing and rounding R = 15 µm

Methods of edge pre-treatment

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

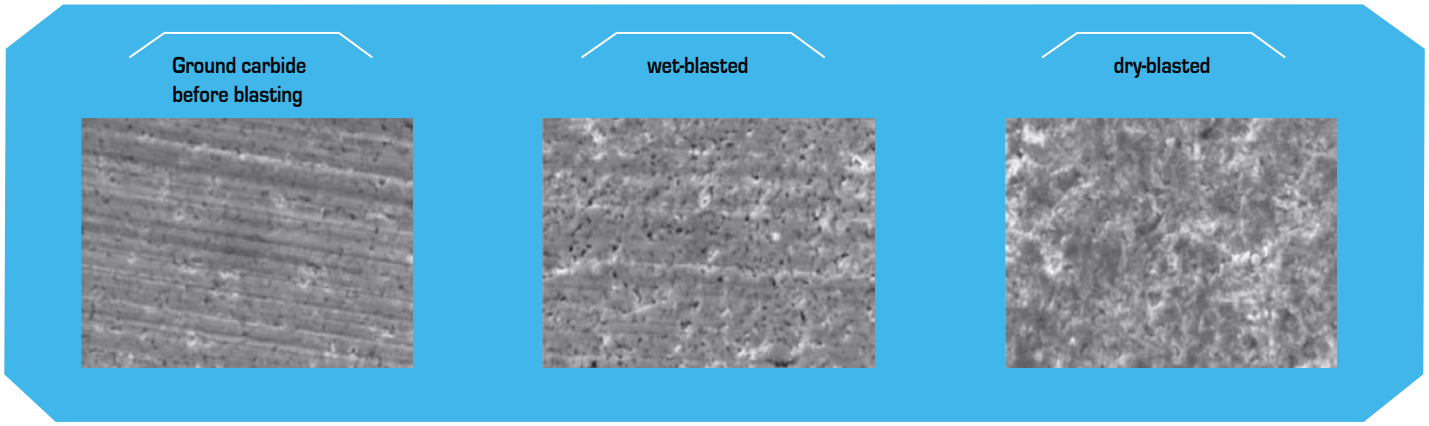
Method		Dry blasting	Wet blasting	Stream finishing	Brushing	Magnet finishing
Tool type	Drills	+	++	++	+++	+++
	End mills	+	++	+++	+++	+++
	Inserts	++	+++	+	++	+
	Hobs	++	+++	+	+	-
	Punches	+	+++	+++	-	-
	Molds and dies	+++	+++	-	-	-
Characteristics	Stability	+++	+++	+++	+++	+++
	Flexibility	+++	+++	++	++	++
	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



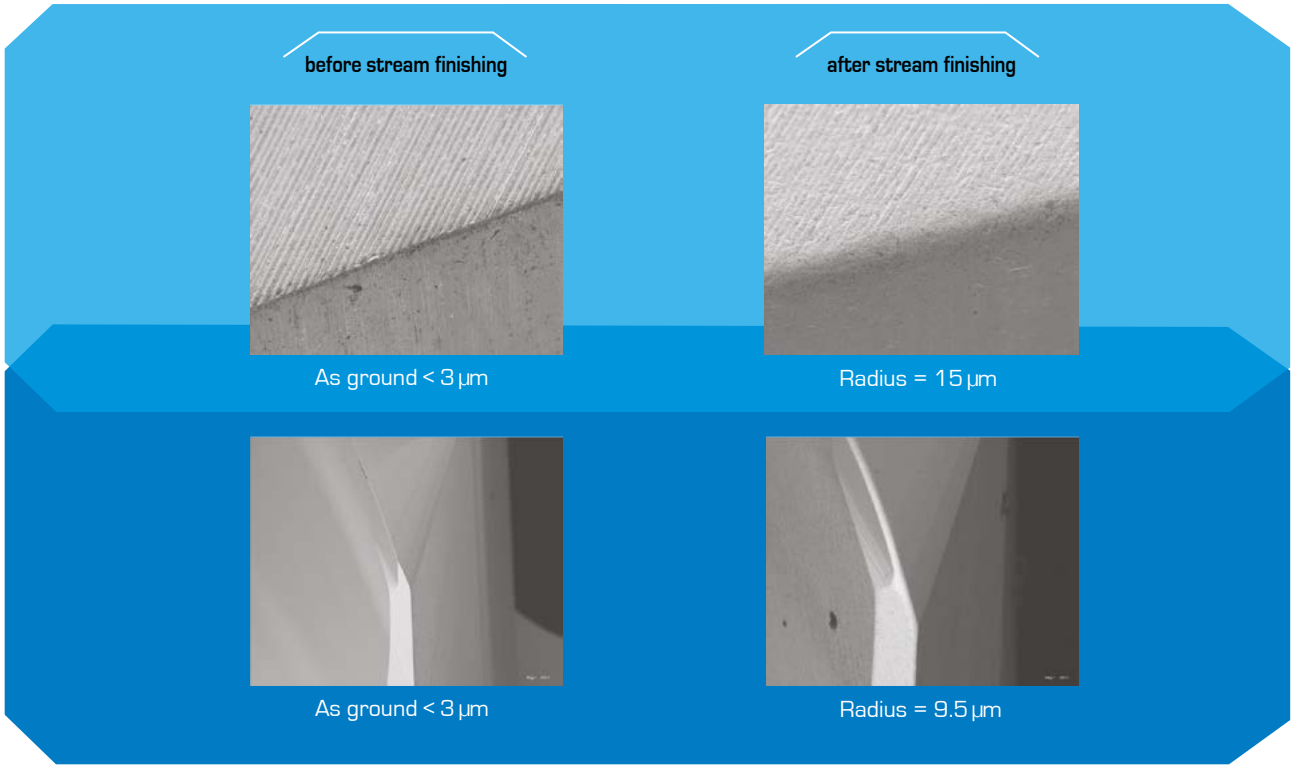
Edge pre-treatment

Comparison of wet and dry blasting

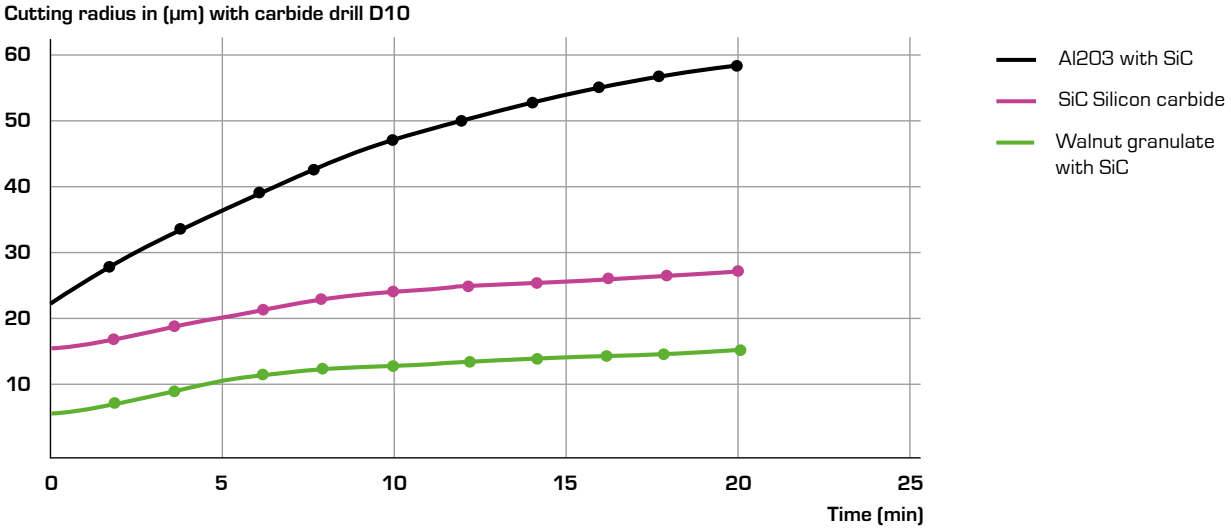


Comparison	Wet	Dry
Surface roughness	Sa = 0.05 µm; Sz = 0.32 µm Slightly shiny surface	Sa = 0.11 µm; Sz = 1.14 µm
Residual material after blasting	Risk of cobalt leaching due to the water	Smearing of the residual material
Coating adhesion	HF1	HF1 – HF3
Edge rounding	Good to control	Difficult to control
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	Pre-cleaning not necessary	Pre-cleaning necessary
	Drying needed after blasting	No need for drying after blasting
	Difficult to clean after interruption	Easy handling even after interruption
	Fewer abrasive inclusions in the tool surface	More abrasive inclusions in the tool surface
	Low surface roughness at the same edge rounding	High surface roughness at the same edge rounding

Cutting-edge rounding and surface quality



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



Cleaning

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

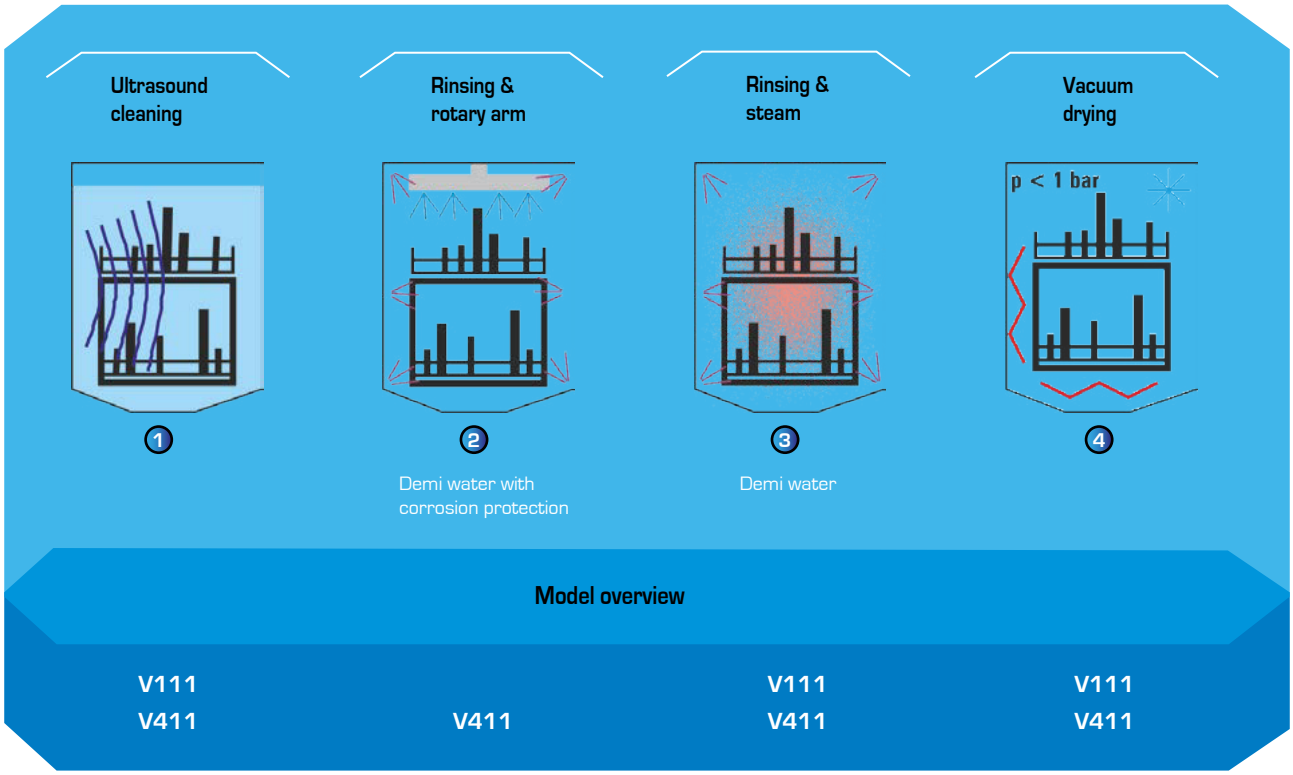
PLATIT offers two different standard sizes of single-chamber cleaning units, which can be tailored to individual customer needs on request, e.g. in terms of:

- Number of cleaning baths
- Bath filtration
- Immersion rinsing
- Tool sizes

AR

Cleaning unit	V111	V411
Chamber volume [mm]	W 350 × D 390 × H 480	W 500 × D 500 × H 500
Loading for shank tools ø 10 × 70 [mm]	504 pcs.	1,008 pcs.
Max. load [kg]	150	200
Cycle times [min]	Approx. 45	Approx. 45

Cleaning cycle



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

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

Quality control

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, as well as adhesion report with scratch tester
- User-defined fields can be integrated
- The data can be filtered and represented graphically to recognize quality trends

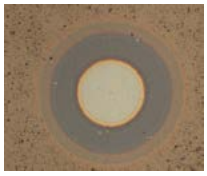
Methods for quality control

The basic quality control methods of a PVD coating are:

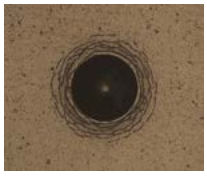
- Coating thickness measurement using a calo tester on test plates and tools
- Adhesion evaluation using a Rockwell or scratch tester

Products and integration services available from PLATIT.

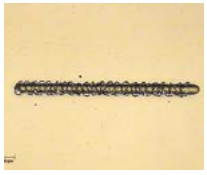
Calo test

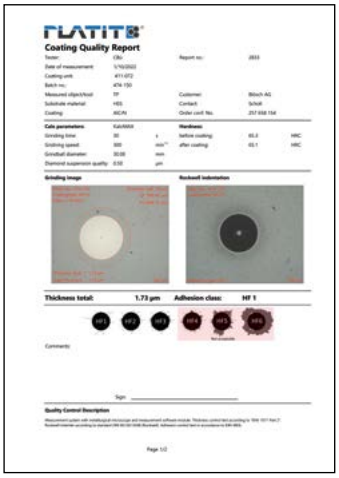


Rockwell test



Scratch test





Coating report

Post-treatment

Objectives of post-treatment

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

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.

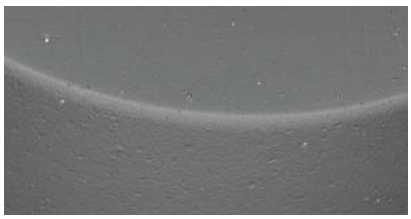
Overview of the most common post-treatment methods

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

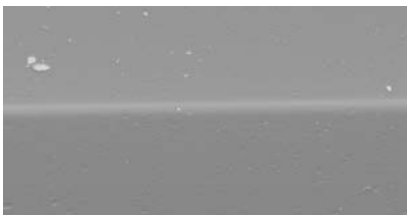
+++ High quality and high efficiency
++ High quality or high efficiency
+ Low quality and/or low efficiency
- Not suitable for the system

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

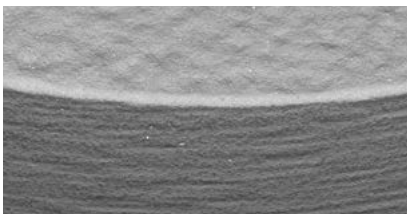
- Immediate full and direct contact of the cutting-edge with the workpiece material
- Low thermal and chemical insulation
- Low coating thickness near the cutting-edge
- A larger cutting-edge radius, which results in a larger surface area without coating
- The impression of a defective coating



Punch coated



Punch coated and wet blasted



Punch polished

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COMPENDIUM

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