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The Most Important Criteria of Coating Users
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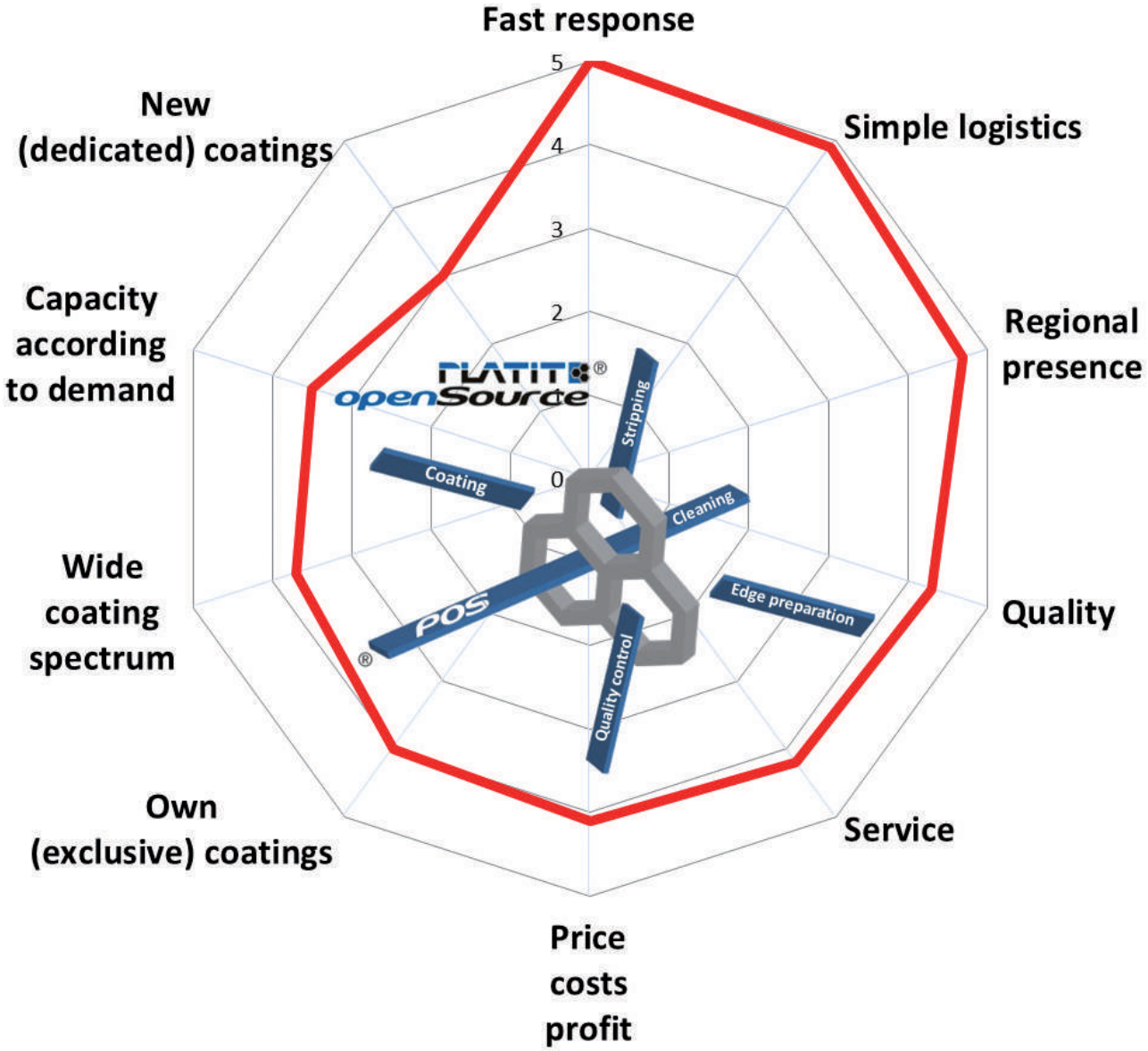
The Most Important Reasons for In-House Coating



Most Important Condition for In-House Coating:
Open Source Cooperation

The 10 Main Reasons for In-House Coating

T. Cselle, CEO, PLATIT AG, Selzach, Switzerland

In 2006/07, the company L.E.K. [1] conducted a large-scale survey among the users of PVD coatings. The main question related to the issue as to which criteria were most important when using coatings. The majority of those surveyed were mainly medium and small tool grinders. The answers and their rankings according to importance gave clear reasons (**Figure 1**) as to why in-house coating has spread so rapidly in recent years compared with coating services.

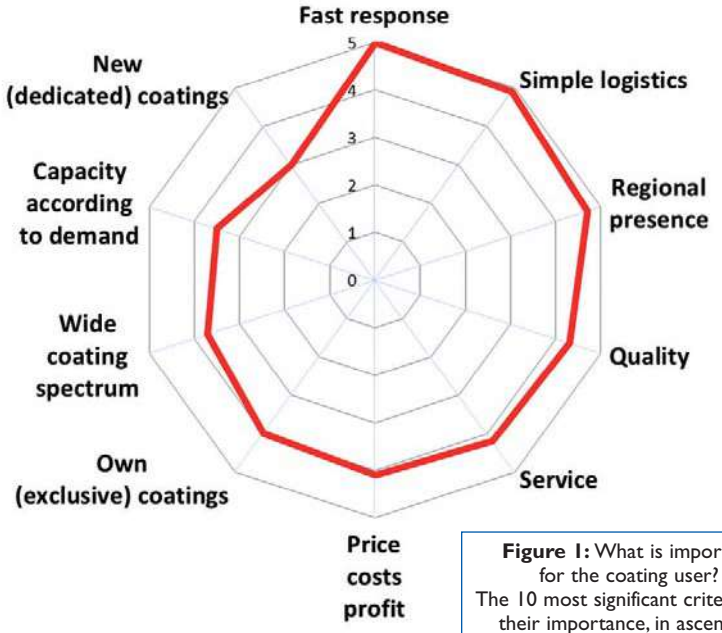


Figure 1: What is important for the coating user? The 10 most significant criteria and their importance, in ascending order from 0 to 5.

Priority 1: Response time (delivery time, production time)

No tool coating provider can pick up, coat and return the tools faster than the in-house coating plant integrated in the production line.

Priority 2: Simple logistics

The best coating providers develop very professional logistics methods for

→ pre-washing, packing, unpacking, cleaning, loading, coating, quality control, repeated packing, repeated transporting, repeated unpacking, repeated quality control and labelling.

In the case of job (service) coating, the probability of errors, of course, is several times higher than in-house coating because of tasks carried out repeatedly and the physical separation. The statistics indicate accordingly that most errors and damage happens during transportation.

Priority 3: Regional presence

Nowhere is closer than in your own company.

Priority 4: Quality

In the meantime, even coating providers (who also want to sell plants) admit that coating is no alchemy and appropriate qualities can be produced in-house even without doctors.

In-house coating can even rule out an important quality problem. Damage to tool material caused by decoating can be eliminated by the correct sequence order (decoating before regrinding) (**Figure 2**). In the case of service coating, this would only be possible by doubling the transportation work.

Priority 5: Service

This is primarily a question as to how deeply the coating provider takes care of the coating user.

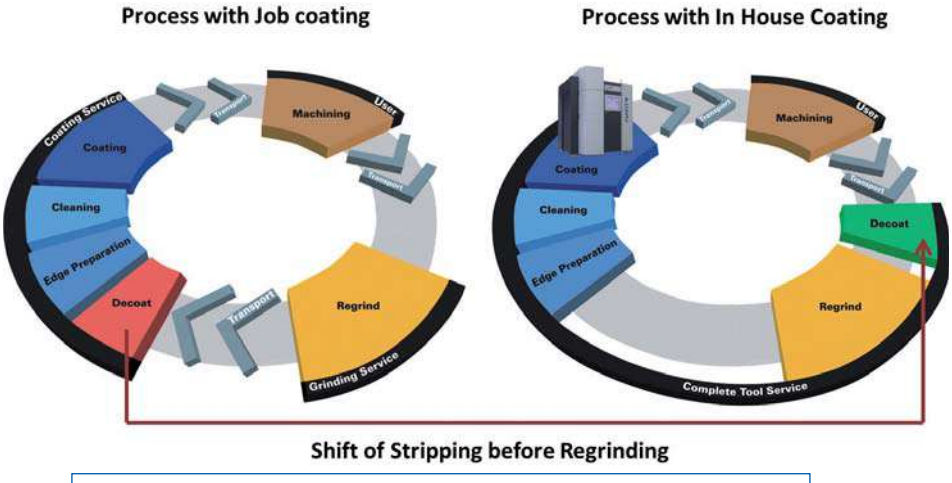


Figure 2: Process operations with job (service) coating and in-house coating.

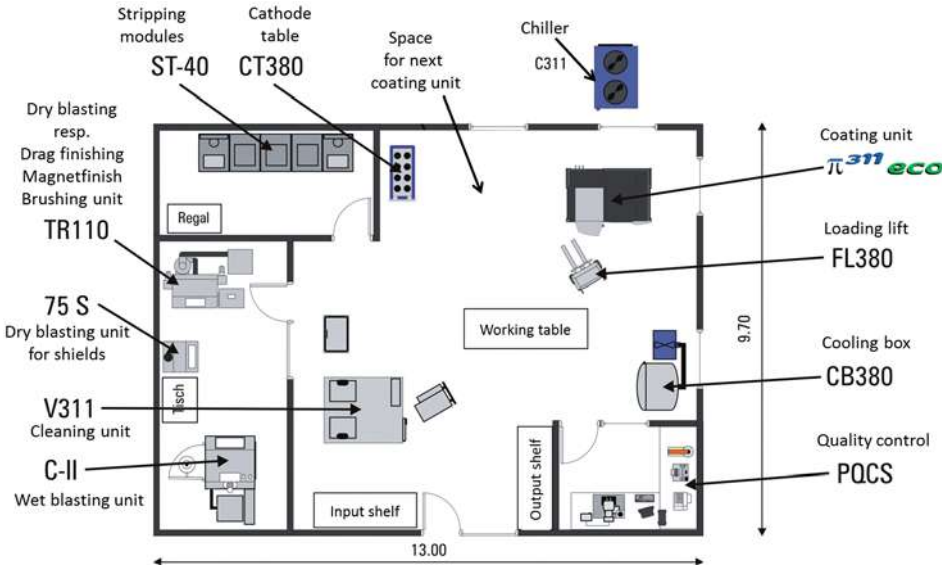


Figure 3: Example layout of an in-house coating system.

- The user primarily expects the job-coating provider to take care of his weekly "needs".
- When choosing the system supplier of an in-house coating, he must first see whether he will be getting a turnkey solution (**Figure 3**) with complete know-how from a single source [2].

Priority 6: Price, costs, profit

Service coating was a moneymaking machine in the 80s, 90s as well as at the beginning of the new millennium. But it is still very profitable even today. The statement by the tool manufacturer Günther Wirth: "The coating plant? That was the best innovation of my professional life." is very true.

Priority 7: Own (exclusive) coatings

It is clearly in the interest of the coating provider to produce as few standard coatings (as possible) in high-productive large-scale industrial plants as large (as possible). Only the very largest among the coating users can consider getting special exclusive coatings from the job coater. (But actually these cannot either, or they have had their own in-house centers for a long time).

Through so-called "dedicated coatings" in their own coating, medium and also very small tool manufacturers and regrinding companies can create their own unique selling propositions. As a result of these coatings adapted to the application, the number of coatings available on the market has truly exploded [3].

Priority 8: Wide range of coatings

To create many different coatings in a plant without involving major alterations and – to be able to reduce costs, very flexible coating systems are needed. LARC®-Technology with rotating cathodes provides the best solution for this [2]. The plant generates the different coatings from non-alloy cathodes by means of software. Today, e.g. with the π311-ECO plant, it is possible to produce 30 coatings with minimum setup time.

Priority 9: Capacity on demand

In the large plants of most coating providers, different tools are mixed which are provided with the same standard coating for the same coating thickness. This is certainly not ideal for the highest performance. For this reason, some coating providers with small plants offer exclusive batches. The user can buy machine batches on certain days when only his tools, according to his parameters (e.g. coating depth, color etc.), are provided.

The in-house coater can plan and utilize his capacities much more flexibly according to his needs. For this purpose, he has a very wide range of small, medium-sized to large coating plants at his disposal (e.g. the 11 series from PLATIT [4]).

Priority 10: New innovative coatings

This, in turn, requires very flexible plants that can be reconditioned better by following the innovation of the market leader. This is only possible if the plants work fully in accordance with the principle of "Open Source". Nobody believed 15 years ago that medium-sized tool manufacturers would be able to create their own high-performance coatings themselves. The numerous coatings successfully introduced on the market prove otherwise (e.g. [5], [6], [7], [8], [9]…)

- Nanosphere: AlCr-based coating for hobbing [5],
- FeinAl: AlCr-based coating for fine stamping [6],
- Unicut: TiAlCN-based coating for milling [7],
- Endutech-Blue: TiAlSi-based coating for drilling [8],
- Igneus: AlTi-based coating for milling [9].

These mostly exclusive coatings are adapted to special applications. For these applications these dedicated coatings provide clearly higher performances than the standard, universal coatings of the job coaters [10]. In addition to the 10 main reasons it is the main goal of the In-House coating.

References:

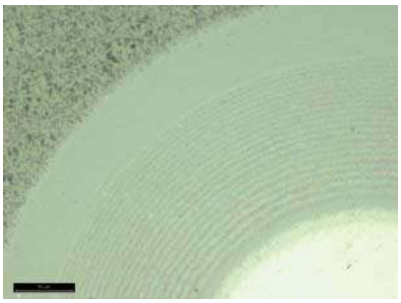
[1] Thin-Film Coating Market – L.E.K. Consulting GmbH, München, 2007
[2] Compendium 2014 – PLATIT AG, Selzach/SO, Switzerland
[3] Cselle. T.: Dedication – Integration – Open source – New Rules in the Coating Industry Werkzeug-Technik, Boulogne, Nr. 118, February/2011, p. 38-43
[4] Series 11 Equipment with Four Coating Generations Werkzeug-Technik, Boulogne, Nr. 134, August/2013, p. 166-173
[5] http://www.lmt-tools.de/waelzfraeser-mit-nanosphere-beschichtung/
[6] http://www.feintool.com/
[7] http://www.fraisa.com/en/assets/media/pdf/kataloge/en/New_tools_2012-1_Milling.pdf
[8] http://www.endutech.de/
[9] http://www.schlenker-wzs.de/beschichtungsanlage.pdf
[10] http://de.slideshare.net/LMTGroup/fachartikel-nanomold-gold

TripleCoatings$^{3®}$

AlCrN$^{3®}$: For Dry Cutting Abrasive Materials

CrN - Al/CrN Multi/Nanolayer - (AlCrN or AlTiN)
Cathodes: 1: Ti – 2: Al – 3: Cr – 4: none

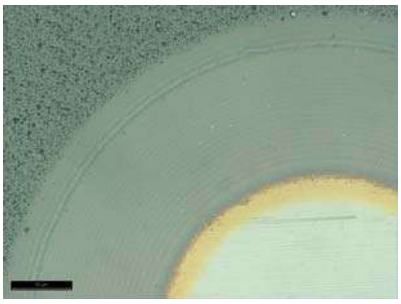
π^{311} eco: 1: Ti – 2: Al – 3: Cr



AlTiCrN$^{3®}$: For Dry and Wet Cutting, Forming

Cr(Ti)N - Al/CrN Multi/Nanolayer - AlTiCrN
Cathodes: 1: Ti – 2: Al – 3: Cr – 4: none

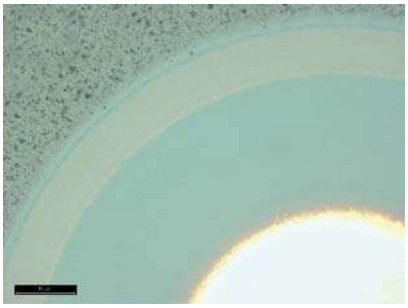
π^{311} eco: 1: Ti – 2: Al – 3: Cr



nACo$^{3®}$: For Universal Use

TiN - AlTiN - nACo
Cathodes: 1: Ti – 2: AlSi+ – 3: none – 4: AlTi

π^{311} eco: 1: Ti – 2: AlSi+ – 3: Al



nACRo$^{3®}$: For Superalloys, Milling, Hobbing

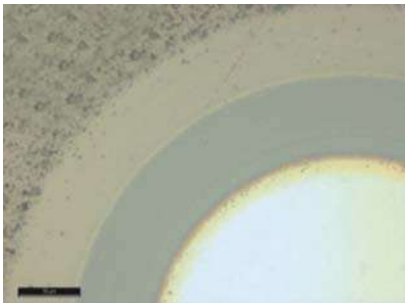
CrN - AlTiCrN - nACRo
Cathodes: 1: none – 2: AlSi+ – 3: Cr – 4: AlTi

π^{311} eco: 1: none - 2: AlSi+ – 3: Cr : nACRo$^{2®}$

TiXCo$^{3®}$: For Superhard Machining, Milling, Drilling

TiN - nACo – TiSiN
Cathodes: 1: Ti – 2: none – 3: TiSi – 4: AlTi

π^{311} eco: 1: Ti – 2: Al – 3: TiSi



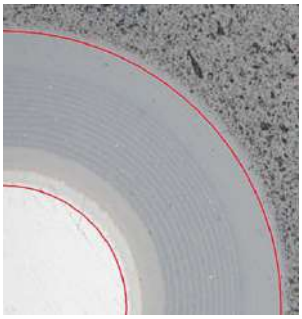
QUADCoatings4®

AlTiCrN4®: For Tapping and Forming

CrTiN - AlTiCrN-G - Al/CrN Multilayer - AlTiCrN
Cathodes: 1: Ti – 2: Al – 3: Cr – 4: AlCr
AlTiCrN4® -Tribo with CrCN toplayer

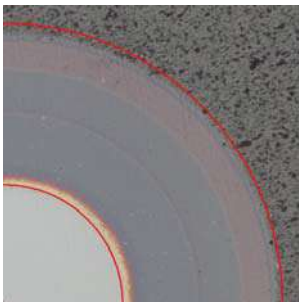
AlCrTiN4®: For Wet and Dry Machining

CrTiN - AlCrTiN-G - Al/CrN Multilayer - AlCrTiN
Cathodes: 1: Ti – 2: Al – 3: Cr – 4: AlCr



nACo4®: For Universal Use

Especially for drilling
TiN - AlTiN-G - AlTiN-NL - nACo
Cathodes: 1: Ti – 2: Al – 3: AlSi+ – 4: AlTi

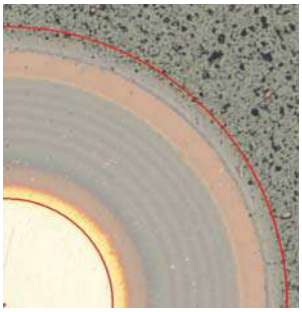


nACRo4®: For Superalloys

Especially for milling and hobbing
CrN - AlCrN-G - AlCrN-NL - nACRo
Cathodes: 1: Cr – 2:AlSi+ – 3: Cr – 4: AlCr

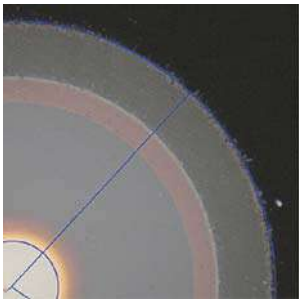
TiXCo4®: For Superhard Machining

Especially for milling and drilling
TiN - AlCrTiN-G - AlCrTiN-ML - TiSiN
Cathodes: 1: Ti – 2: Al – 3: TiSi – 4: AlCr



nACoX4®: For HSC Dry Turning and Milling

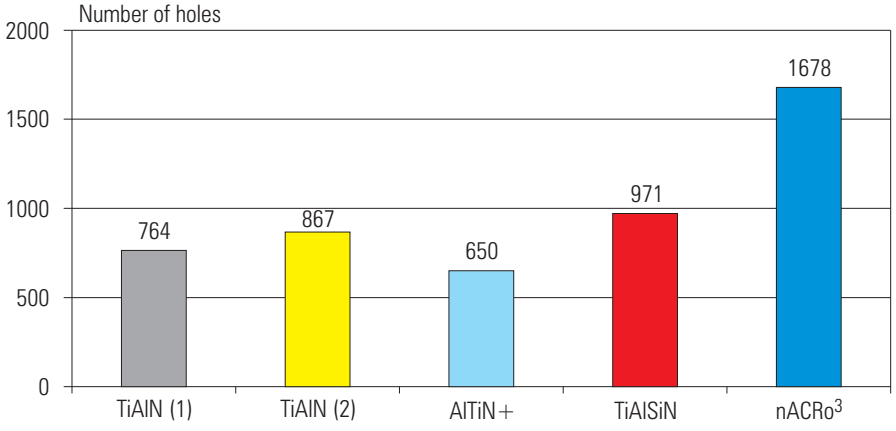
TiN - AlTiN - nACo - AlCrON
Cathodes: 1: Ti – 2: AlSi+ – 3: AlCr-OXI – 4: AlTi



Applications with TripleCoatings^{3}®

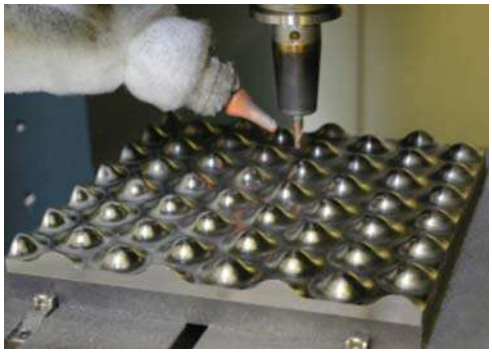
Drilling

Tool Life Comparison

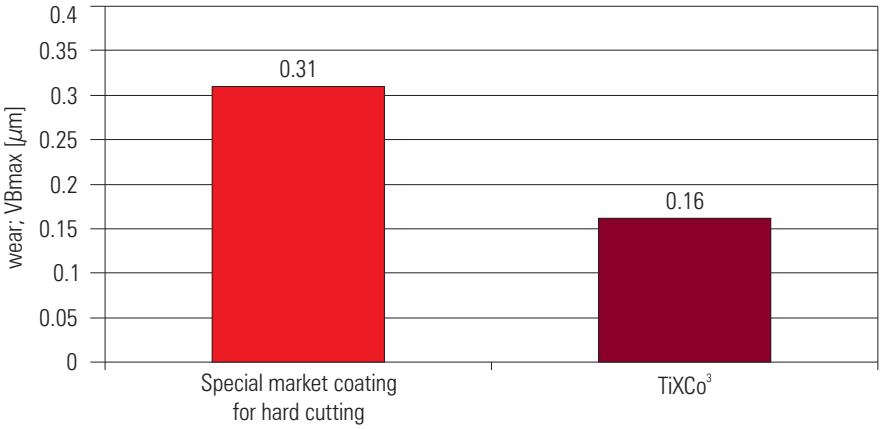


Solid carbide drill; Ø 8 mm; DIN6539-D8 – Work material 42CrMoV, HRC 30~32; successive cutting; drilling depth ap=24 mm Vc 150 m/min; 5968 rpm; feed/rotation f=0.15 mm; feed rate vf=895 mm/min; coolant 8% – Source: TDC Dalian, China

Super Hard Milling

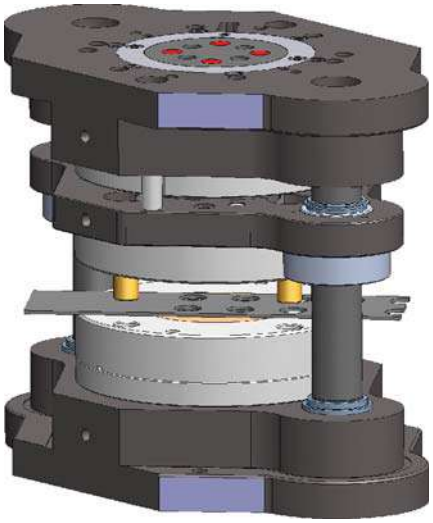


Wear Comparison

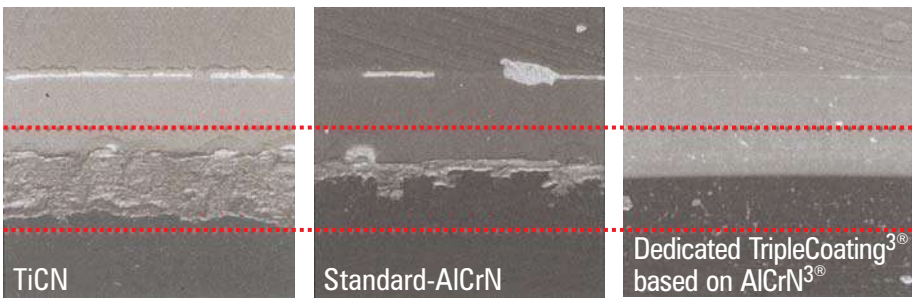


Work piece material: X210Cr13, 1.2080, 64 HRC – Tool: Ball nose end mill – d=6mm n= 16'820 1/min – ap=0.09 mm – ae=0.06 mm – f=0.1 mm/rev
Coolant: cold air 5 bar – Developed and tested for HyoShin, South Korea

Fine Blanking



Comparative Analysis (SEM) after 30'000 Strokes



Coating detached, maintenance urgently needed.

Element requires preventive maintenance.

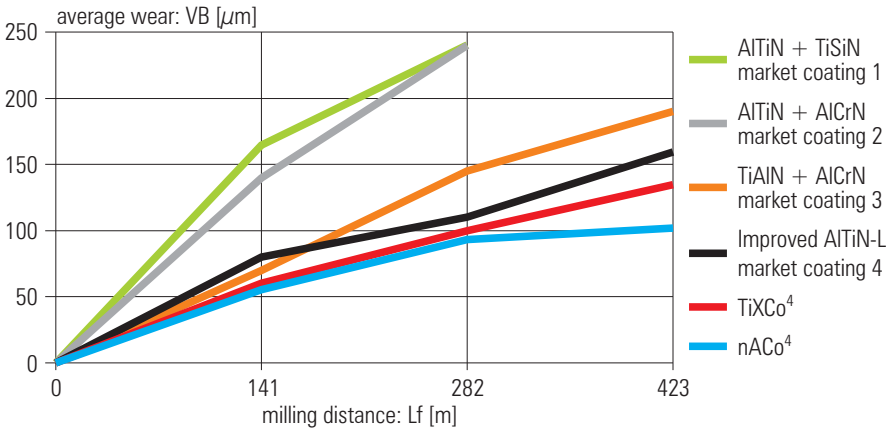
Element can continue in service.

Source: Feintool, Lyss, Switzerland

with QUADCoatings4®

Milling

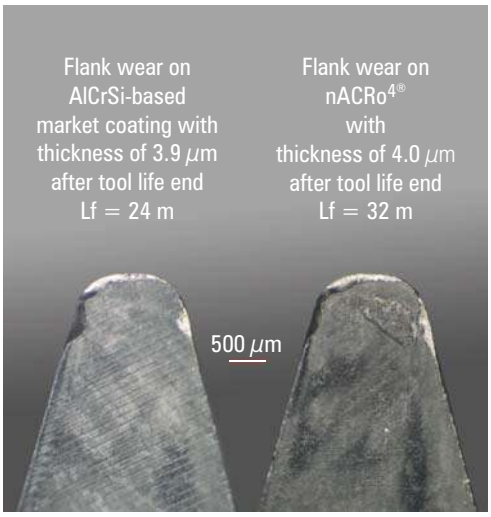
Wear Comparison at Hard Milling with Inserts

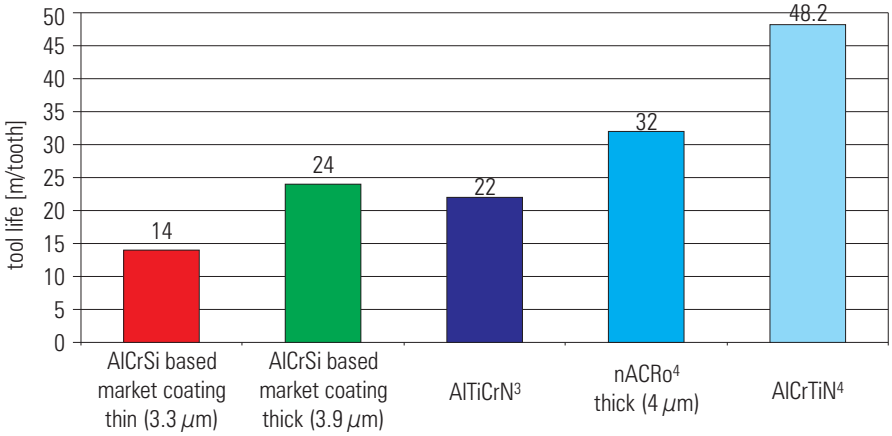


Workpiece: Wave profile - Material: X155CrVMo12 - 1.2379 - hardened to 55 HRC - coolant: IC-air
Tool: WPR 16-SF - vc=240 m/min - fz=0.2 mm - vf=1910 mm/min - ap=0.2 mm - ae=0.3mm
Tested by LMT-Kieninger, Lahr, Germany

Hobbing

Tool Life Comparison at Dry Hobbing

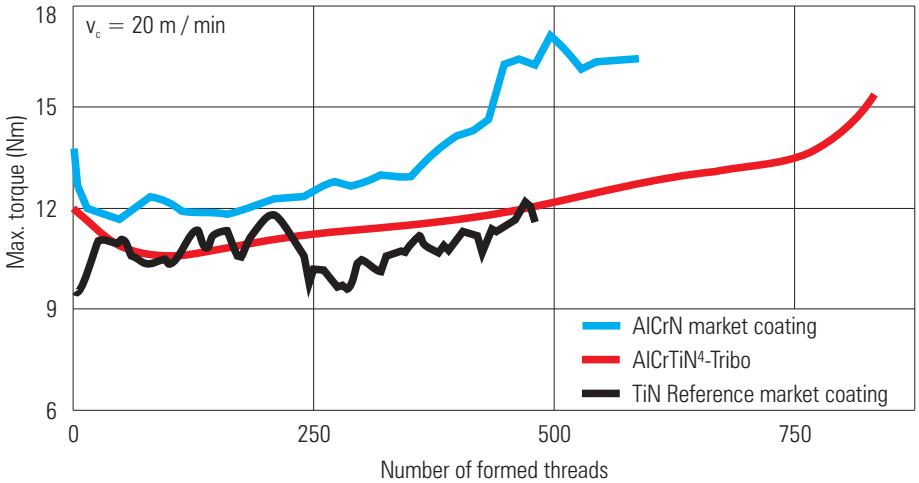




Mat. : 20 MnCrB5 - m=2.7
Tool: 2-teeth - PM-HSS - vc=150 m/min - fa=1.7/work piece revolution - with 5 gears
Measured at the University of Magdeburg, Germany

Thread Forming

Spindle Torque Measured in High Strength Steel



Work piece material: 40CrMnMo7 - Rm= 945 N/mm2
Tool: M8-InnoForm1-Z - HSSE 23/1 – Ø7.4 – ap=1.5xd - Minimum quantity lubrication (MQL)

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Advanced Coating Systems
SWISS QUALITY
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- Coatable volume: ø485 x 440 mm
- 504 end mills d=10 mm / batch
- Optimal for shank tools, hobs, forming tools, and machine components
- All common market PVD coatings
- Triple**Coatings**^{3}®
- Upgradeable to DLC^{2}-coatings on site
- Upgradeable to π311 on site

Other Coating Machines of the 11 Series

π111

π211

π411

The 11 Series refers to the magic number «11» of PLATIT's home canton, Solothurn.