DEDICATED COATING SOLUTIONS

PLATIT®

Greater machining efficiency thanks to dedicated coating solutions

The transformation of the manufacturing industry is in full swing and is also having an impact on the manufacturers of precision tools. In addition to high-alloy steels, aluminum plays a special role in the automotive sector as it does in the aerospace industry, where it has proven itself alongside CFC and superalloys titanium and Inconel. Beyond new tooling concepts and technologies (e.g., stator housing machining for electric motors), it is important to continually improve performance in terms of service life or machining parameters. A corresponding performance improvement can be achieved by a coating tailored to the individual needs of the respective application [Dege24].

From signature coating to dedicated coating

Starting with a detailed analysis of the application including the existing wear mechanisms the next step is sampling of a signature coating which is a unique PVD coating for dedicated applications (Figure 1) [Plat24].

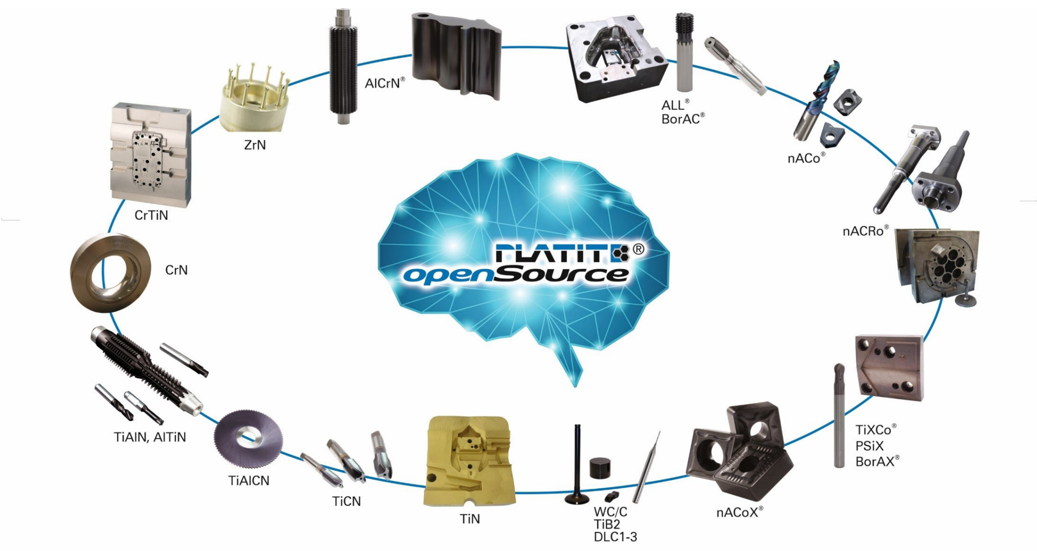


Figure 1: The right coating for the appropriate application

Before the coating is applied the substrate must be free of contaminants at the atomic level. This can be achieved in high-vacuum PVD systems by means of a glow discharge process, which is achieved by igniting a plasma on the carousel in the PVD system prior to the deposition process. Thanks to PLATITs patented 3D plasma etch-indicator (Figure 2), this step in the process allows one to adapt the etching parameters to specific geometries thereby significantly improving performance [dihw22].

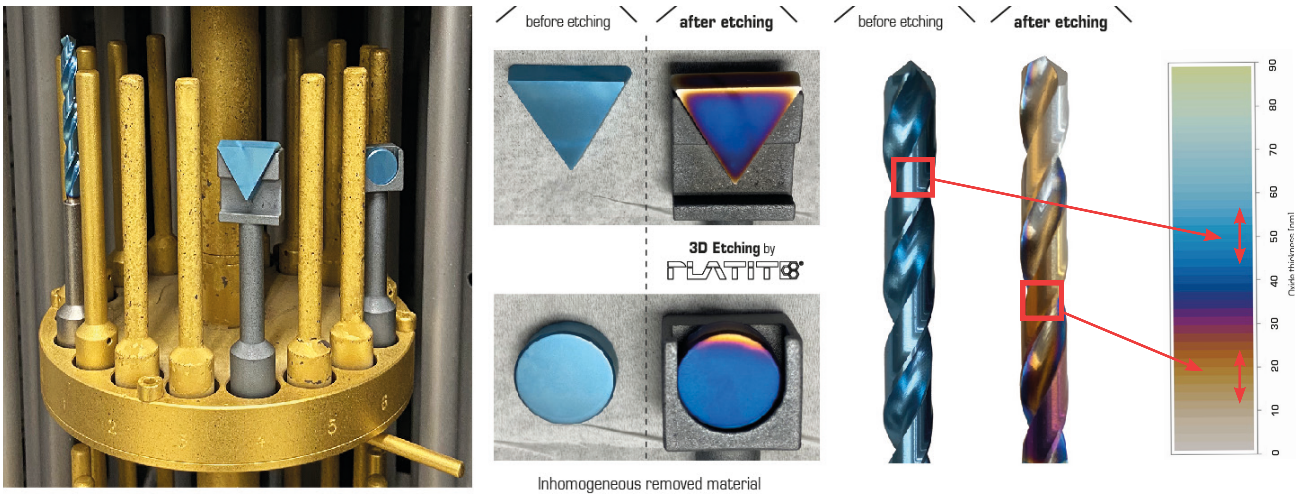


Figure 2: Optimum coating adhesion thanks to the 3D etch-indicator

In order to master the technical and production related challenges of applying PVD coatings a flexible and modular system design concept is required. Thanks to our cylindrical cathode technology the compact and modular PLATIT Pi411 PLUS (Figure 3) allows for maximum process flexibility. Due to a variety of configurable options, it is possible to deposit coatings using methods or technologies such as classic arc evaporation (arc in the Eco or Turbo mode), sputtered coatings (SCIL® technology) or the combination of both technologies to create so-called hybrid coatings (LACS® technology). With the unique LACS® technology, the door cathodes (arc) run in combination with the central SCIL® cathode. This option package is rounded out by allowing the flexibility to apply DLC (diamond-like carbon) or oxide coatings on cutting tools [Plat23], [Werk14].

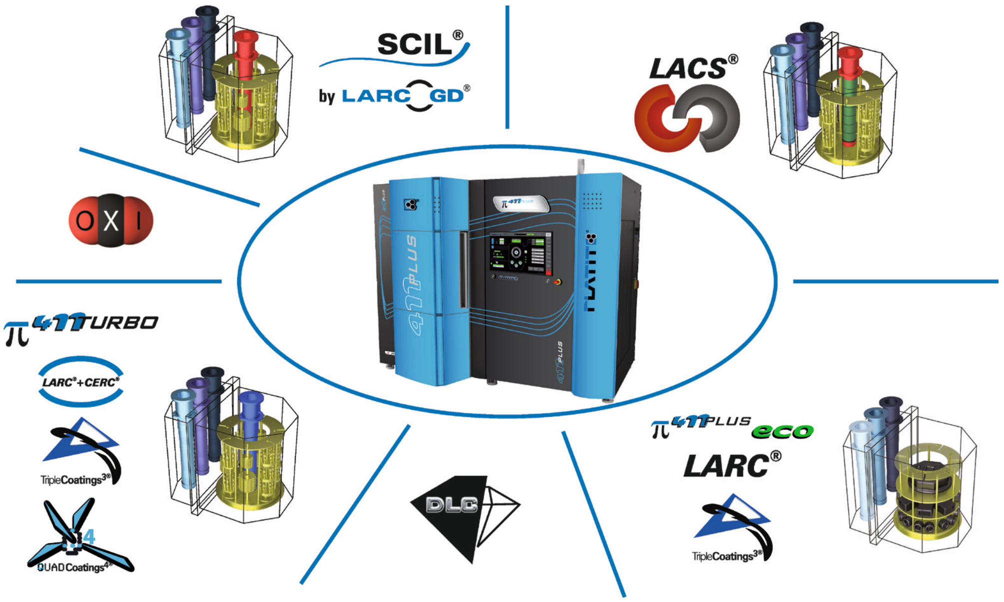


Figure 3: Pi411 PLUS - maximum performance with maximum flexibility

Even the best coating cannot achieve its full performance potential if the cutting edge is improperly pretreated. Therefore, in the fourth step, a targeted edge preparation is essential. Depending on the tool type and application this can be achieved by means of the following technologies, wet or dry microblasting, brush honing, laser or vibratory conditioning (Figure 4) [Plat12]. In addition to creating a homogenous and stabile cutting edge, the rounding process reduces chipping, cracking or breakout which also reduces residual stress. The amount of radius applied to the cutting edge also has an influence on the coating thickness that can be deposited, in turn higher coating thicknesses can be applied to the cutting edges with larger radii [Plat23], [Plat24].

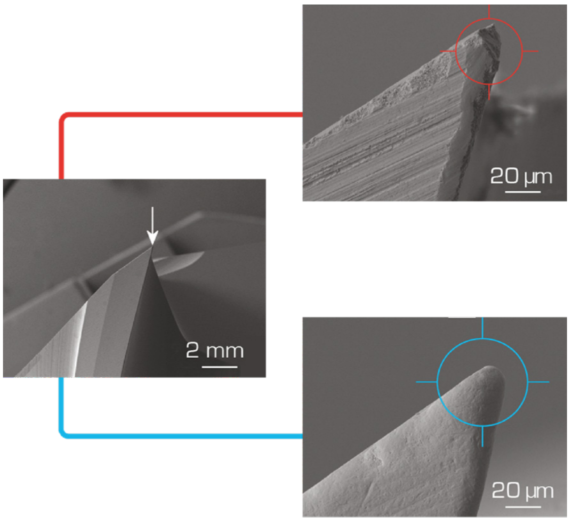
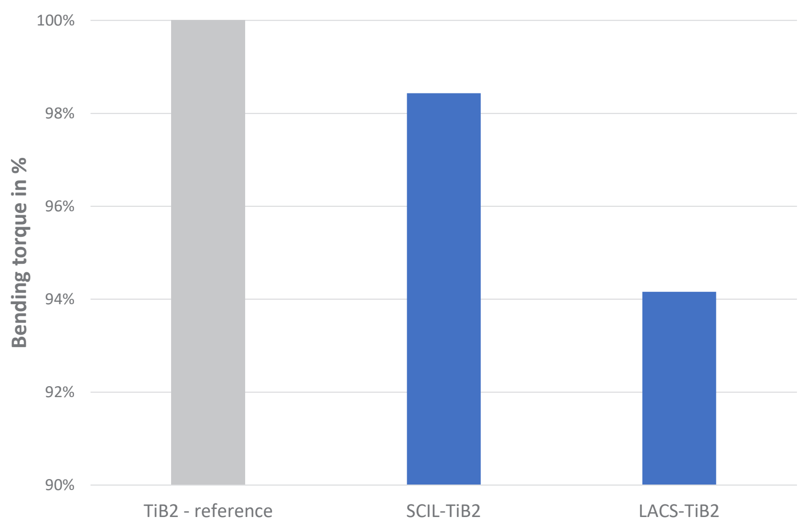


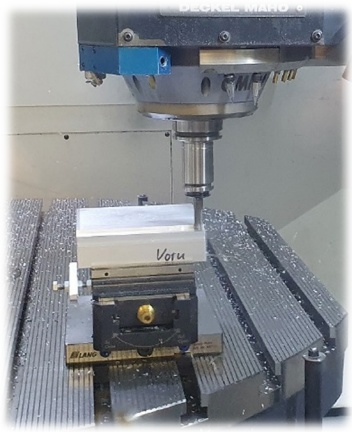
Figure 4:
Targeted preparation of a cutting edge
top = as ground,
bottom = after rounding

Our open-source approach allows users to have a targeted influence on individual coating formulations or recipe steps to achieve maximum performance in a highly productive manner with low cost per unit coated [Werk14].

TiBor – LACS® coating for aluminum and titanium machining

Due to their material-specific properties, both aluminum and titanium tend to build up on the cutting edges during machining which has a detrimental effect on the service life of the tool and the surface finish of the workpiece. Smooth surfaces and droplet-free coatings are essential in preventing built-up edge. At the same time in order to efficiently perform their task, cutting tools must be sharp. The titanium diboride-based coating TiBor (Table 1) meets or exceeds these requirements thanks to (LACS®) deposition technology and it's wear resistance characteristics (Figure 5).





Test: Milling with emulsion
Tool: SC endmill Ø8 z3
Par.: vc = 600 m/min, f = 0.18 mm/z, a_p = 18.0 mm, a_e = 2.0 mm

Figure 5: TiBor

Table 1: TiBor characteristics

Color	Satin silver
Nanohardness [GPa]	45
Coefficient of friction [µ]	0.4
Coating thickness [µm]	1-5
Max. application temperature [°C]	600
Coating temperature [°C]	200-400
Pi411 PLUS LACS®	(Ti, -, -, SCIL-TiB2)

The universal coating - TiXCo4

TiXCo4 (Table 2) is an AlCrN/TiSiN based coating that has the ability to perform well in a wide range of applications. In addition to the machining of alloyed and hardened steels, this coating demonstrates its strengths when machining the nickel-based alloy Inconel 718 thanks to its high thermal stability. Together with KSF Furtwangen, extensive investigations were carried out focused on wear resistance, workpiece surface quality and the machining forces occurring during corner milling of Inconel 718 (1,250 MPa) using Ø8 end mills (milling time 15 min or VBmax > 100 µm) (Figure 6). Based on a summary of the aforementioned criteria, TiXCo4 was able to achieve a significant performance advantage. [Plat23], [Plks23]

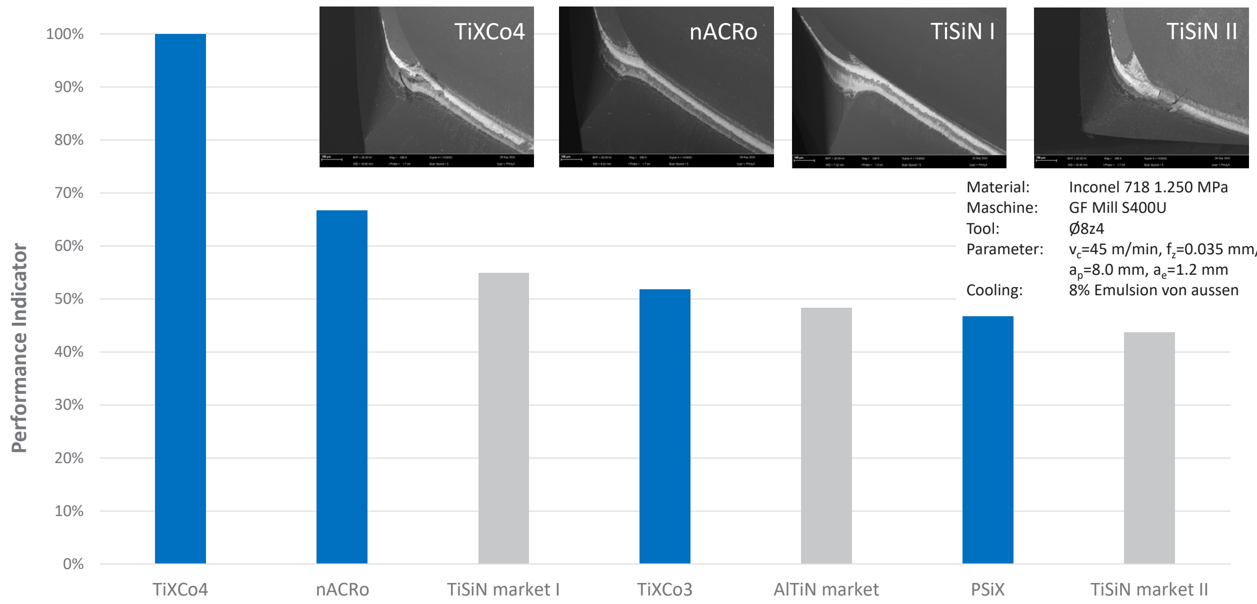


Figure 6: TiXCo4 – Milling of Inconel 718

Table 2: TiXCo4 characteristics

Color	Grey
Nanohardness [GPa]	42-44
Coefficient of friction [µ]	0.4
Coating thickness [µm]	1-4
Max. application temperature [°C]	1,100
Coating temperature [°C]	450-500
Pi411 PLUS TURBO	(Ti,Al,TiSi20, AlCr30)

Summary

Signature PVD coatings are uniquely tailored solutions, yet individual components in the process chain can be tuned to meet specific application criteria, including pre - and post-treatment (Figure 7).

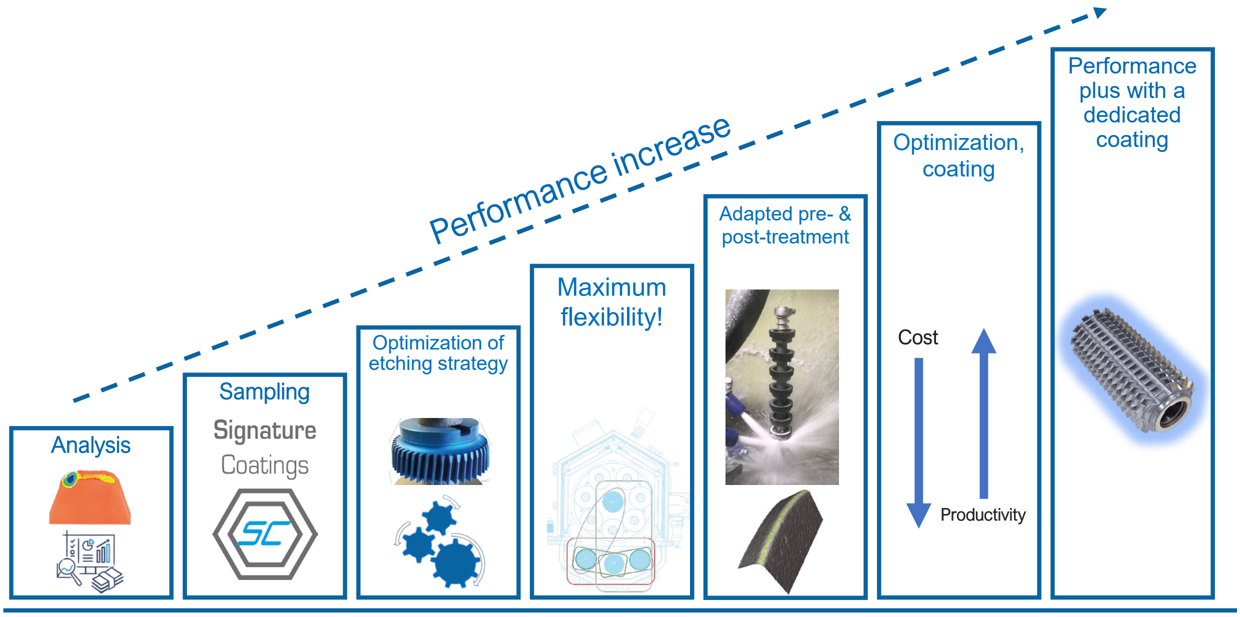


Figure 7: Building blocks for performance plus

- In addition to visualization the 3D plasma etch-indicator also makes it possible to improve the etching process which enhances coating adhesion.
- Thanks to a variety of configuration options the PLATIT Pi411 PLUS offers maximum flexibility and an optmized performance level of the deposited coatings.
- Targeted preparation has a positive effect on the stability of the cutting edge.
- TiBor is noteworthy for its wear resistance and droplet-free surface when machining aluminum and titanium.
- TiXCo4, the universal coating with a performance advantage when machining Inconel 718.

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