PREPRINT

Werkzeug Technik

Technologie - System - Logistik

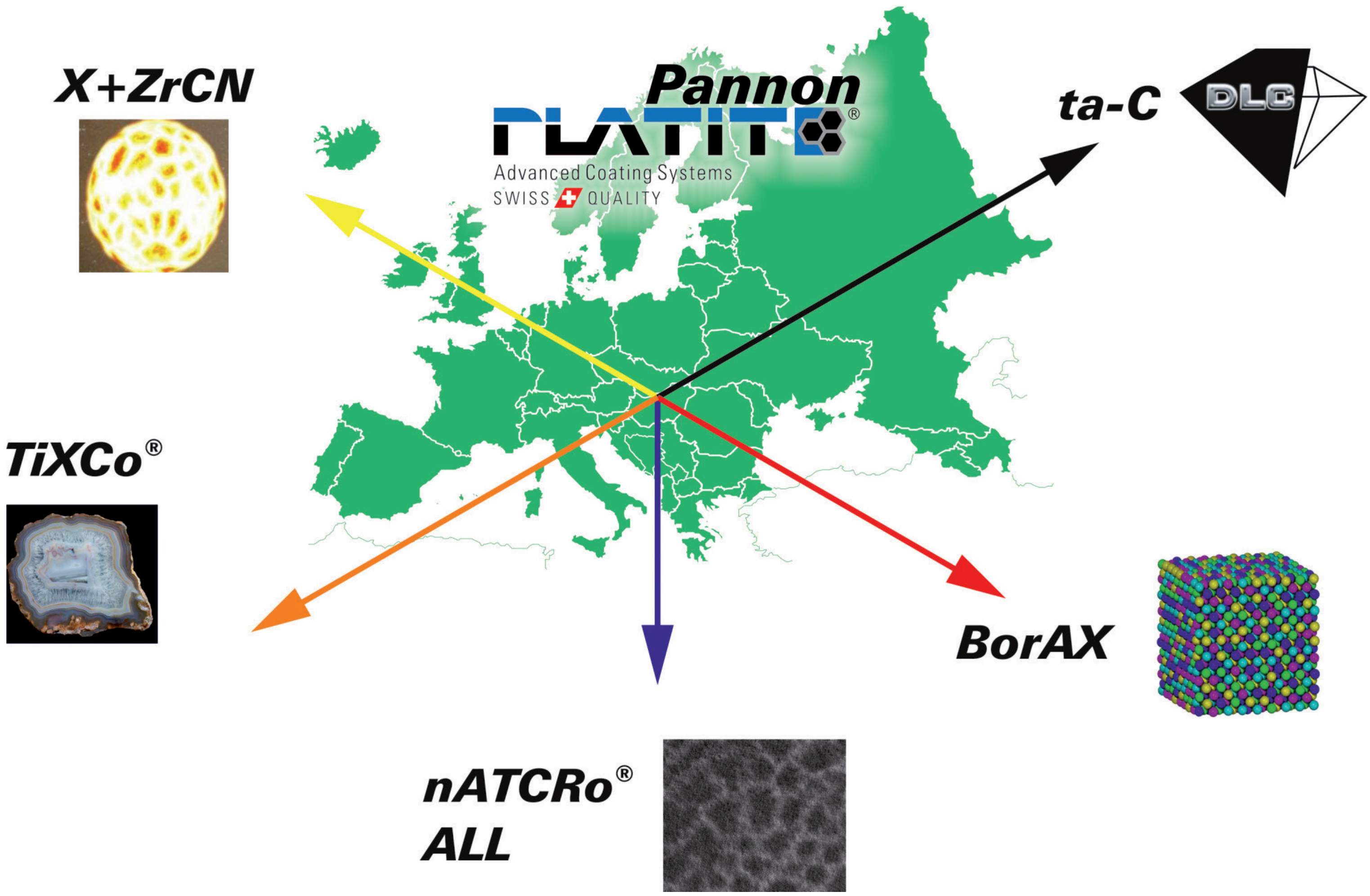
ISSN Nr. 0997 - 6981
www.werkzeug-technik.com

25 August 2020
Nr. 183

Technical magazine for cutting tools and measurement in the manufacturing

Small – Fine – High

Flexible Service with New High-Performance Coatings



Small – Fine – High

Flexible Service with New High-Performance Coatings

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Fig. 1: New Innovative Coatings, available from PannonPlatit.

PannonPlatit [1] is a small but fine job coating center near to Budapest, in the heart of Hungary.

Pannon has been offering a very flexible and fast service since 2005, including pre- and post-treatments (with dry and wet micro-blasting, drag finishing, brushing) and the latest PLATIT® technologies with 3 coating units. In addition to conventional ARCs, hybrid (ARC + sputter) processes can be carried out.

The basic drive of the company is the production of innovative new layers.

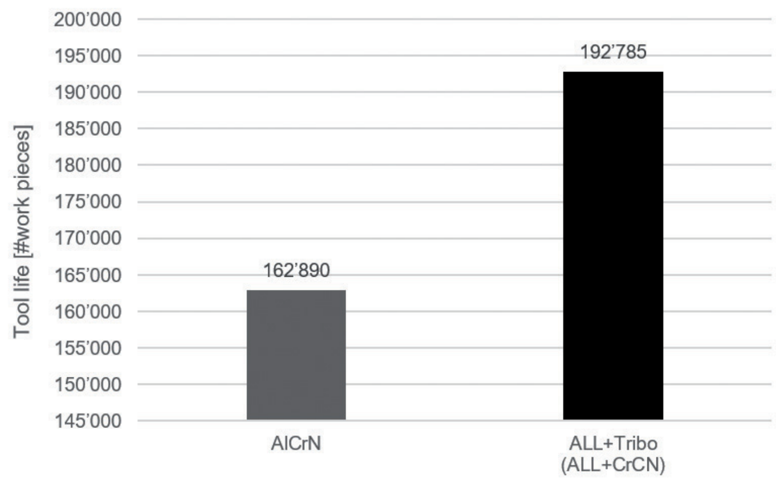
nATCRo – ALL® - Universal for very different applications

The common universal layers (such as TiN, AlTiN, AlCrN etc.) are of course also offered if the customer absolutely wants them ...

Pannon has been used nATCRo® as a base layer for many years, over 40% of sales are generated by this coating. It is a nanocomposite layer with a continuous nanolayer structure. It contains Ti, Al, Cr and Si, i.e. all elements that form the backbone of today's PVD layers. It can do replace all universal layers, named before, and offers higher performance and enables cost-effective job coating operations.

nATCRo® can be used for a wide range of cutting tools. Sometimes it is too hard and brittle for forming. You take out the silicon and use the ALL® layer, which is depicted as a nanolayer (Ti, Al, Cr)N composition. To improve the gliding behavior, the ALL® is supplemented with a top tribological layer CrCN (**Fig. 2**).

With a (or a few) base coating(s) you cannot do innovative job coating today. Adapted layers are required for the various applications in order to meet the requirements of the different users. Let us show a couple of new, interesting examples from Pannon:



Tool material S600 (58-60Hrc) & K890 (60-62H) with oil - stroke / min: 25 bis 40

Work piece material: S420-MC (EN-10149-2) & S275JR (EN-10125)

Thickness of material: 4.5 bis 7mm – Source: HNCF, Italy

Fig. 2: Tool life comparison at fine blanking.

TiXCo® - For hard cutting and for more

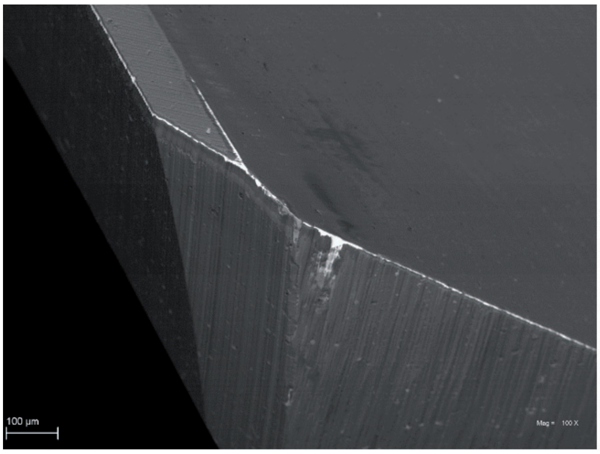
TiXCo® also includes the above 4 basic elements (Ti, Al, Cr, Si), but it is constructed as a multilayer (CrTiN, CrTiAlN, TiSiN), uses an uppermost, extremely hard TiSiN top layer, which predestines the layer for hard machining.

Impressed by the performance of the layer in hard machining, the layer was also used by customers in other ways. Good results were found at wet graphite cutting even against CVD diamond layers or at reaming.

We carry out the assessment of the cutting behavior in close cooperation with the University of Obuda within the framework of EU projects (**Fig. 3** [3]).

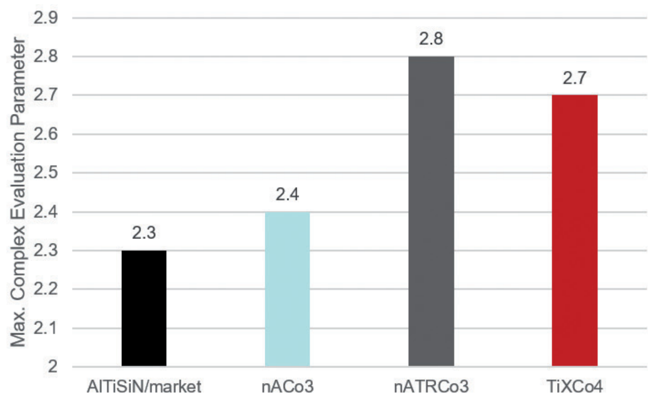
X + ZrCN - Top layer to avoid built-up edges

ZrN is a recurring well-known coating, primarily used for aluminum processing. Alone, it performs well as a base layer, but it is too expensive to replace the TiN. Supplemented with carbon nitride, it is currently experiencing a renaissance as a top lubricating layer that is overcoated on a hard base layer.



A, SEM wear pattern of a drill with nATCRo³ coating at the end of the test

Tested solid carbide drills: Ø6.8 and Ø13.1 mm
Work piece material: 39MnCrB-2 – Rm=1000 N/mm²
vc=60, 70, 80 m/min – ap=20, 27, 34 mm – blind holes
f=0.17, 0.21, 0.25 mm/rev –
Internal coolant: emulsion 8% - 3.8l/min



B, Comparison of the cutting behavior of different tools with the help of the CEP factor

CEP: Complex Evaluation Factor: CEP = V * α1 / Mc * α2 / Ff * α3 / g * α4 / h [mm³ / (min * Nm * N]
V: Cut work piece volume [mm³ / min]
Mc: Torque [Nm] (to evaluate the torsional strength of the tool)
Ff: feed force [N] (to evaluate the pressure resistance of the tool)
g: chip form factor (to evaluate chip formation, i.e. the tool geometry)
h: cost factor (to evaluate manufacturing costs; carbide, grinding, coating)

Fig. 3: Evaluation of cutting behavior of solid carbide drills [3].

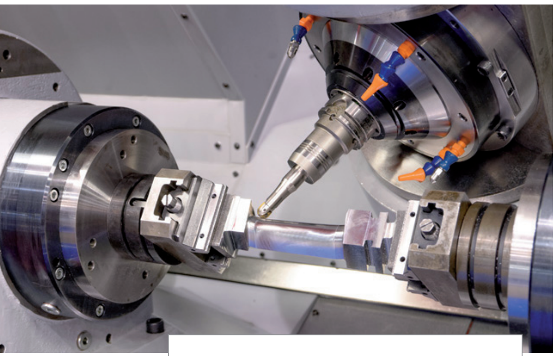


Fig. 4: Milling of turbine blades with an X+ZrCN-coated ball plate.

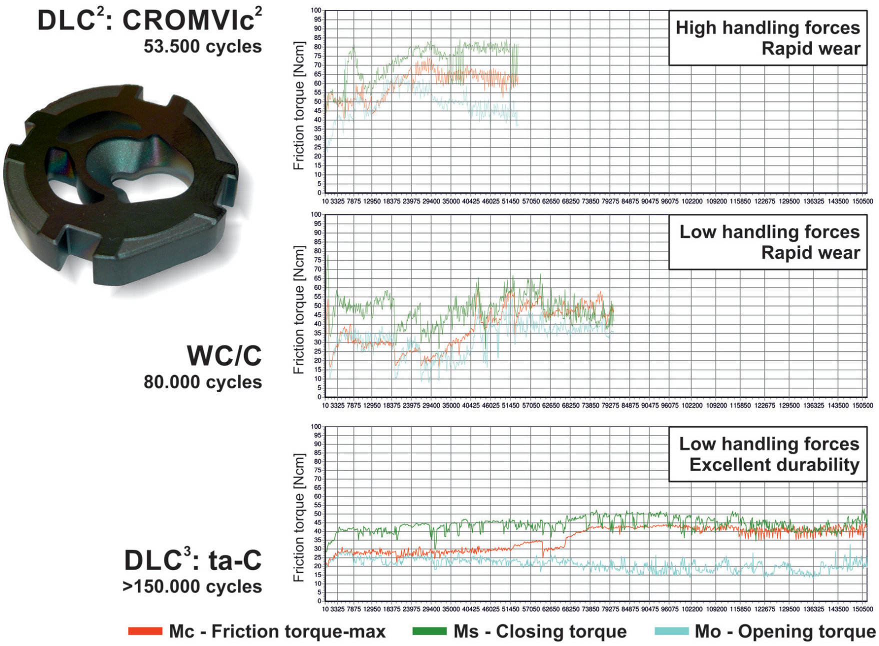


Fig. 5: Comparison of the frictional torque of different DLC-coatings on a ceramic closure wear element.

The combination of TiB_2 and ZrN is interesting for machining aluminum, whereby the usual 2 layers are doubled.

We were able to achieve particularly excellent results when milling (**Fig. 4**) superalloys (e.g. Nimonic) using the layer combination nA(T)CRo+Zr(C)N and BorAC+Zr(C)N [user: Siemens, Budapest].

ta-C - The hard DLC layer for components and micro tools

DLC¹ and DLC² layers with hydrogen are based on metals, nitrides, water and carbon. The carbon (mostly from acetylene) is deposited as a top layer as a lubrication layer [1].

One can speak of hard DLC layers, of ta-C coatings over a 50% proportion of sp_3 crystals. It means a hardness above 50 GPa and a roughness smaller than S_a = 50 nm. The thin (~ 1um) layer is ideally suited for coating micro tools and components that are exposed to constant frictional loads on the moving components (**Fig. 5**).

BorAX - High Entropy Coating: The next big step in coating technology?

High entropy alloys are the current hype in metallurgy. The 5 or more components form alloys that have significantly better physical properties than conventional alloys. E.g.

- better strength / weight ratios,
- higher bending and tear strength and
- higher resistance to corrosion and oxidation.

Why should it be different with coatings. The first results of the BorAX = Crn-AlCrTiN/BN/SiN layer prove this statement (**Fig. 6**). The continuous dosing of boron enables simultaneous high toughness with high hardness [4].

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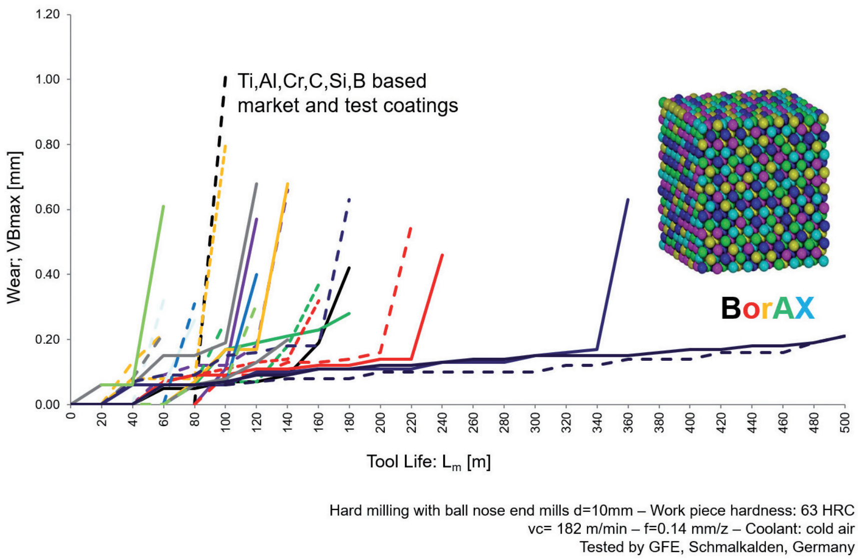

Fig. 6: High-Entropy Coating in wear comparison to conventional coatings [4].

Referenzen

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