The Flagship, PLATIT’s high-performance unit, the π411 (Fig. 1) is considered one of the most flexible coating machines in the world. It is a part of Series 11, whose systems cover a wide range of machine sizes from small to medium to extra-large [1].

– In its basic configuration, the machine works with 4 rotating ARC cathodes, for which PLATIT provides a life-time guarantee via the global cathode exchange centers [2]. They make a wide variety of hard coatings possible:
  • practically all conventional nitride coatings,
  • Nanolayer and Nanocomposite coatings, and
  • TripleCoatings and QuadCoatings.
– The OXI option helps to achieve the ARC deposition of oxide and oxynitride coatings at high temperatures. These can be used first and foremost for indexable cutting inserts instead of CVD coatings [3].

– The SCIL® option [4] works with the special high performance sputter technology, which produces extremely smooth coatings. They can be used e.g. for threading tools.
– The DLC² option [5] primarily serves to coat components with a-C:H:X coatings in order to reduce the friction coefficient. In addition to machine components, DLC coatings are often used to cut materials that tend to form built up edges (Ti, Al) [6].

Also this year the Flagship π411 obtained several new developments and options:

1. Quick Process Upgrade
– Lightweight elements for reducing heating and cooling time of masses and to make handling easier for operators:
  • lightweight carousels and
  • lightweight tool holders (gearboxes)
– Pre-heating of the chamber to decrease the outgas period and to prevent condensation
– New shielding system for the door, to achieve higher etching efficiency in less time (LGD [7]) and to simplify service
– New system software with optimized overlapping etching and heating.

2. Service Concept
The new service concept is based on a service activity [8] planned and conducted on a regular basis (e.g. semi-annually). The machine is connected to a database online. Over a protected internet connection the user can query the service activities that have been performed as well as those that are to be performed. He can check the spare parts that are used as well as those that are to be used and have access to ongoing hotline help. This service concept reduces maintenance costs, maximizes the operating hours of machines and increases the guarantee period.
3. Expanded Coating Program Package

All of PLATIT’s coatings are structured in accordance with the open source philosophy [9]. This means that every user receives detailed information about the structure of the coatings and can develop their own coatings using the open control unit with or even completely without PLATIT support.

This year, too, numerous new coatings were developed and upgraded for the π411 (Fig. 2). Upgrades are available for customers who bought the original program at no extra charge.

We would like to draw your attention to three particularly interesting coatings and coating upgrades [10]:

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- **AlCrN³ for fine blanking**

In cooperation with the company Fein- tool, this layer was developed as a nanolayered coating with a triple structure. It provides a performance that is at least 30% better than the coatings previously developed for this area of application [11], [12], [13].

- **ALL® (AlCrTiN⁴) for hobbing**

This QuadCoating was developed as the next generation of the famous Nanosphere, which serves the world’s best car makers and hob grinders in six different global centers belonging to our corporate partner, LMT-Fette [14], [15].

For large hobs (D=150-220 mm), it is necessary to remove the central cathode and then carry out the coating with only the three lateral cathodes (LARC®: LAteral Rotating Cathodes). Dedicated for this process PLATIT developed the “eco” machines and coating series. These processes are of course slower than those with the “booster”, the central cathode (CERC®: CEntral Rotating Cathode). But, the coating performance is excellent. For dry hobbing with a fast cutting speed of vc=180 m/min, they trump the newest market coatings and demonstrate a significantly lower degree of crater wear (Fig. 3).

The eco version of the π411 is very often used for coating of bigger forming tools and or saw blades up to d=550 mm.

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- **TiXCo³ for hard machining**

These layers contain enormous amounts of silicon. Nanocomposite formation induced by Si doping results in extrem high coating hardness (< 40 GPa). Their main use is machining hardened materials (> 60 HRC) [16]. We were also quite surprised that this coating in composite materials (Al, Ti, CFK) performs even better than the CVD diamond coatings [17].

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**Outlook**

The upgrade options, the service concept and the new coating programs are already standard for the new machines, and the existing machines can be upgraded on site. Their combined use will help to speed up processes by up to an hour and more. Under certain circumstances, this could mean an additional batch per day. (15516-??)
Fig. 3: Comparison of tool life and crater wear with new coatings at dry hobbing.

References

High Power Coating with High Flexibility

- 4 cathodes run simultaneously
  - 3x LARC® Lateral Rotating Cathodes
  - 1x CERC® Central Rotating Cathode
- Deposition of TripleCoatings® and QUADCoatings®
- High deposition rate
- Fast heating and cooling
- Short cycle time
- Up to 6 batches / day even with 6 different coatings

High Loadability

- Robust and easy change of loads

Optimal Adhesion due to

- VIRTUALSHUTTER® and TUBE SHUTTER®
- LARC® GD

Process Times

- The fast-process upgrade reduces door to door time down to 3.5 hours.

OXI-Option

For deposition of oxide and oxynitride coatings
(Al, Cr)O - (Al, Cr (O, N): nACoX)

DLC®-Option

PVD/PEPVD process. For deposition of a-C:H:X coatings on the base of silicon:
cVlc, cVlc, CROMVlc, CROMTIVlc, nACVlc

SCiL®-Option

- Sputtered Coatings induced by SCiL-TIN, SCiL-TiCN, SCiL-TiB
- SCiL® sputtering cathode is used instead of CERC®

The Most Important Features of the \( \pi^{11} \)

The \( \pi^{11} eco \) version is very often used for coating of forming tools and saw blades up to D=550 mm.