journal of

hp tooling

Dr. Harnisch Publications
ISSN 2628-5444

high precision tooling

Machine Tools, PCD, PVD, CVD, CBN, Hard Metal

2020 - 2

- Process-reliable face milling with a long tool life
- Laser technology for tool manufacturers
- AI for predictive maintenance
- High-speed metrology and inspection system

BE A WiN NER!

WiN woodworking 2020

Dr. Harnisch Publications

Atlanta Special:

The new WiN woodworking INTERNATIONAL is the only general international magazine for experts in the entire woodworking industry.

Our August issue will focus on the IWF in Atlanta, the most important woodfair in 2020.

This is a great opportunity for you to enter the american market.

With your advertisement in WiN you'll reach out to our readers and the visitors of IWF in Atlanta, where WiN woodworking INTERNATIONAL will be present with its own booth at the fair.

The next WiN woodworking will be published in August.

FIMMA Maderalia · WOOD TECH WARSAW EXPO · Xylexpo · FORMÓBILE · IWF ATLANTA · DREMA · FHaV · SICAM

Invest in the new start

Eric Schäfer
editor-in-chief

Many people feel that the world is currently turning more slowly. In many places there is a "state of emergency", for months to come we will have to live with restrictions of all kinds. Nobody can predict exactly what the world will look like after that. But it is important to prepare for the time when the economy slowly starts to pick up speed again.

For example, if production is still reduced or stopped, you can carry out preventive maintenance. Or you invest. It's not as crazy as it sounds at first. If you invest in production now, whether in new machines or innovative tool solutions, in a complete process, automation or the future viability of your plants, you will secure a competitive advantage when normality slowly returns towards everyday production.

Maybe you think laser when you think about investments. Laser technology is an innovation that has developed considerably in recent years, as the technical report on *page 28* shows. New applications have emerged in many technical areas. The laser is being used more and more frequently in the production process as well as in toolmaking and opens up new possibilities for tool manufacturers. What advantages this brings in practice is described in a user report about an Italian tool manufacturer who successfully expanded his production technologies with laser technology. For the first time in this issue you can take a look at other new processing machines that rely on laser technology. Machines that should actually have their premiere at a trade fair. In times of cancelled and postponed trade fairs, it is trade magazines such as *"hp tooling"* that appear reliable and bring these innovations to you. And as an additional service in this issue, you will receive an up-to-date overview of whether and when which trade fairs will take place in the coming months.

See you at **www.harnisch.com**

Eric Schäfer
editor-in-chief

Next regular AMB to be held from September, 13 to 17, 2022

Exhibitors back the decision

The next regular AMB will then be held in its regular cycle in Stuttgart, September 2022, 13 to 17. The new exhibition date creates planning security for every participant during the difficult economic situation at present. Messe Stuttgart actively included the exhibitors and the promotional supporters, i.e. the VDMA *Precision Tools Association*, the VDMA *Software and Digitalisation Association*, and the *German Machine Tool Builders' Association* (VDW), in this important decision.

Roland Bleinroth, President and CEO of Messe Stuttgart emphasised: "The vote by the exhibitors gave us a clear mandate, thus enabling us to end the speculations surrounding the feasibility of AMB 2020. At the present moment with all the regulations relating to hygiene, social distancing or restricted travel possibilities and the current general economic conditions, an AMB such as we know cannot be staged this year."

Although the exhibitor survey conducted by Messe Stuttgart clearly showed that there is no adequate basis for an AMB exhibition this year, there is definitely interest in a format in Stuttgart for this autumn. Messe Stuttgart is therefore planning an *AMB Forum* for the first time in the present AMB week (September, 14 - 18, 2020). Featuring specialist industry-specific talks in the ICS International Congress Center Stuttgart, an accompanying table top exhibition and different matchmaking services, the Forum will bring together players in the industry who are interested in and need a platform in autumn.

"The AMB project team is now closely involved in designing and planning the first AMB Forum, and is starting the preparations for AMB 2022," added Gunnar Mey, Department Director Industry at Messe Stuttgart.

further information: ***www.messe-stuttgart.de***

table of contents

cover story

materials & tools

processes

machining center

components

departments

fairs in alphabetical order with original date				postponed to
	AMB	Stuttgart, (September 15-19, 2020)	Germany	September 13-17, **2022**
	bauma CHINA	Shanghai, (November 24-27, 2020)	China	**not** postponed
	CCMT	Shanghai, (April 7-11, 2020)	China	new date unknown
	EPHJ	Genf, (June 16-19, 2020)	Switzerland	September 15-18, 2020
	FABTECH	Toronto, (June 14-16, 2020)	Canada	June 14-16, **2022**
	FEIMEC	São Paulo, (May 5-9, 2020)	Brazil	new date unknown
	GrindTec	Augsburg, (March 18-21, 2020)	Germany	November 10-13, 2020
	Hannover fair	Hanover, (April 20-24, 2020)	Germany	April 12-16, **2021**
	IMT	Brno, (October 5-9, 2020)	Czech Republic	**not** postponed
	IMTS	Chicago, (September 14-19, 2020)	USA	**not** postponed
	intertool	Vienna, (May 12-15, 2020)	Austria	new date unknown
	JIMTOF	Tokio, (December 7-12, 2020)	Japan	**not** postponed
	METALEX	Bangkok, (November 18-21, 2020)	Thailand	**not** postponed
	Metalloobrabotka	Moscow, (May 25-29, 2020)	Russia	May 24-28, **2021**
	Metallurgy Russia + Litmash Russia	Moscow, (June 9-11, 2020)	Russia	June 8-10, **2021**
	METAV	Düsseldorf, (March 10-13, 2020)	Germany	March 23-26, **2021**
	SIMTOS	Goyang, (March 31-April 4, 2020)	South Korea	October 5-9, 2020
	Stone+tec	Nuremberg, (June 17-20, 2020)	Germany	May/June, **2021**
	Surface Technology	Stuttgart, (June 16-18, 2020)	Germany	October 27-29, 2020
	TIMTOS	Taipeh, (March 15-20, **2021**)	Taiwan	**not** postponed
	TMTS	Taichung, (November 10-14, 2020)	Taiwan	**not** postponed
trade fair dates as by end of May, 2020; we are not responsible for reliability of these dates				

Polished results with CCR and S-Cut

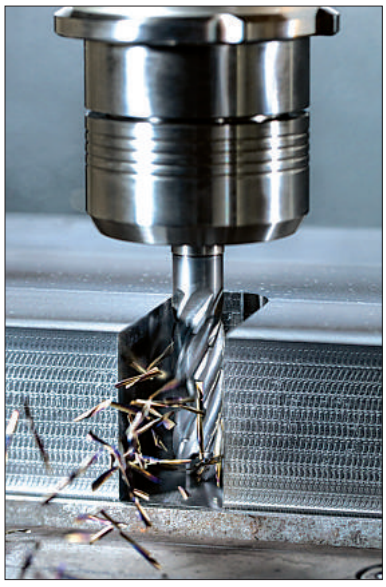
Comprehensive service from Ceratizit delivers process security and efficiency at *Herzog CNC Zerspanung*

The demands of the pharmaceutical industry generally go beyond the norm when it comes to material, machining strategy and quality. This means that those who want to establish and prove themselves in this area must possess the necessary expertise and optimum technical equipment. An example is *Herzog CNC Zerspanung,* based in Anröchte, Germany, who can handle any machining challenge - thanks, in part, to tools from Ceratizit.

Founded in 2005 by *Andreas Herzog* as a contract manufacturing company it grew rapidly, and the company moved into a newly constructed production facility in 2010. With an initial focus on general mechanical engineering it gradually expanded the range of industries it serves to include pharmaceutical, automotive, packaging, robotics, agricultural and food industries.

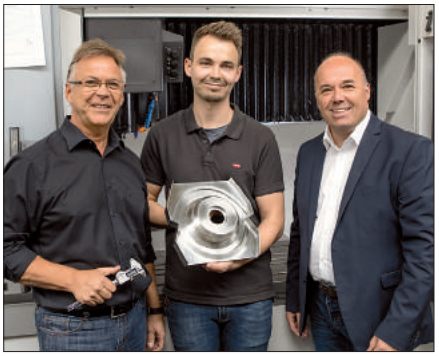
The most rigorous demands fulfilled right off the bat

"One customer for whom we have manufactured an increasing amount of ever more challenging parts in recent years is *L. B. Bohle Maschinen + Verfahren GmbH* from Ennigerloh, about 50 km away from us. The company specialises in handling and process machinery for the pharmaceutical industry, and they wanted to reduce the forty or so suppliers they were working with to around five or ten, to maintain direct personal contact," remembers Andreas Herzog.



The CCR milling cutters are ideal for trochoidal milling strategies and enable an extremely high chip volume

Andreas' son, *Marcel,* takes up the story: "In addition to the normal milled and turned parts we were already producing for them, L. B. Bohle wanted us to make a polished and eccentrically ground component. Therefore, we produced a couple of test parts - and the customer was thrilled right from the start!" The part was by no means easy to produce, machined from a special kind of stainless steel with a form that consisted of bars that were just 2 mm wide and 20 mm high, with small corner radii and tight corners which were barely possible to pass through. The clamping devices had to be selected with millimeter precision to offer the milling cutters a chatter-free hold, while gripping on the minimum of material.



Excellent interplay between the machining experts at Herzog CNC Zerspanung: Andreas Herzog, Marcel Herzog GbR and Thomas Sicke, Technical Advice & Sales\Cutting Tools at Ceratizit

"The finished component needs a total of three clamping operations. In the first operation the outside profile and the thread were milled ensuring that the material removed did not affect the stability of the component. After this, all the other sides were machined. The final clamping operation was to machine the grooves, with positional tolerances of 0.05 mm. Total cycle times were up to 12 hours, depending on the specific component" explains Marcel Herzog.

Trochoidal talent

To improve machining processes trochoidal milling techniques were used. "Although it wouldn't have taken any longer with the 'old' milling techniques, I might have had to use ten times as many tools," says Marcel Herzog. "Trochoidal, in contrast, is process-secure and the tool life is excellent. Best of all, it didn't need any intervention from me! I knew that roughing now took just under two hours leaving me free to take care of something else during this time."

High-quality tools save time and money

In its early days the company opted for very cheap tool solutions, but his strategy quickly changed: "When Marcel took over the task of tool procurement, it didn't take much to convince me that prioritising quality over price is an extremely good approach! The result is that everything is now from Ceratizit's portfolio. Our project with L. B. Bohle clearly shows that everything hinges upon durable and process-secure tools." This is not a gut feeling, but a fact backed up by numerous examples. "One tool that is used at Herzog is, in the truest sense of the word, outstanding: we received the *Hans-Jürgen Warnecke Innovation Award* from the *Fraunhofer Institute for Manufacturing Engineering and Automation* (IPA) for the S-Cut. Its special, S-shaped side profile reduces vibrations, resulting in a long tool life. Therefore, many of our customers use it for volume production, where it delivers a 50 to 60% longer tool life," says *Thomas Sicke,* Technical Sales Engineer, Ceratizit.

Ten in one go

These S-Cut tools were used for rough machining the L. B. Bohle component. "During 3D roughing, it removed everything with ease with a full depth and 2.5 mm step-over. In terms of chip volumes, this was tremendous. But the fact that the S-Cut let me produce ten parts without changeover left me speechless!" says Marcel Herzog. Initially Marcel Herzog decided to play it safe and stocked up on all the tools. "Five 12 mm, four 10 mm and six 8 mm milling cutters for precision work. I used two of each at most!" His father was suitably impressed: "My son showed me tools that had been used for a long time. They looked as if they had never been used!"

"Fitting" use

Also reducing cycle times at Herzog are CCR Circular-Line milling cutters with their long cutting lengths and chip breakers delivering high chip volumes and shorter runtimes. "These cutters have saved us a huge amount of money. We needed to rough mill 12 mm of material, when using a competitor's tool, I had to index the inserts three times. Now I can do exactly the same thing with just one cutting edge!" says Marcel Herzog.

Getting it down pat with the *Tool-O-Mat*

To help manage tool usage Herzog CNC Zerspanung is using the Tool-O-Mat tool dispensing system from Ceratizit, which has brought even greater flexibility: "Some specific tools are needed for a special order, which might only be requested once a year. To avoid running out of tools in case of damage, we have a Tool-O-Mat, from which I can simply draw the next tool. Once the stock falls below the minimum level, it is automatically replenished and I don't need to worry about it!"

As a consignment store, the Tool-O-Mat also frees up some capital in the company. Instead of placing tools into drawers at a cost of several thousand euros, the customer only takes and pays for the tools they actually require. "What we gain in planning reliability is virtually priceless," says Andreas Herzog.

Fast and effective support

When it comes to after-sales service, Andreas and Marcel Herzog can completely count on their advisor Thomas Sicke. "When dealing with application technicians from other manufacturers, I often got the impression that it would be a long road to the desired result involving test runs, but with Mr. Sicke it is completely the opposite. When I describe a task to him, he recommends a specific tool to me, tells me the possible cutting speeds, the feed and then it can get under way. Right off the bat, we have shortened our process times and thereby saved good money so many times."

The "Tool-O-Mat" tool vending machine from Ceratizit

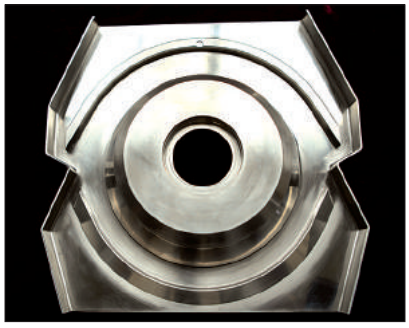
Thomas Sicke also believes that this only works when you interact as equals: "Marcel Herzog understands exactly what I mean and implements it, because, for one thing, he has a feel for the machine in question. He knows what he is doing and so the recommended tool is able to deliver the best results!"

On the hunt for a zero error rate

Reliability and stringent quality standards are not just the preserve of plant engineering for the pharmaceutical industry. Which is why Herzog has always believed in having everything documented and checked (by two people) from receipt of goods to goods dispatch - and this has paid off. "We even help customers carry out quality assurance to some extent. Over the years we have built up such a foundation of trust, as customers know that if it's from Herzog, it'll be flawless," adds Andreas Herzog.

Full steam ahead into the future!

By focussing on special machining tasks, Herzog CNC Zerspanung stand out from the crowd. Their success rests upon a careful selection of state-of-the-art machinery and a wide-ranging portfolio of tools. "And we must not forget our specialist personnel. We employ experienced machining specialists - and now we can even train them ourselves. Our first trainee just passed his exam with the mark 'very good'," notes Andreas Herzog proudly. There will never be a dull moment at Herzog - the requirements are usually far too unique for that. "This is also something that sets us apart from the rest: we make the parts that not everyone wants to make or is able to make. And when customers come back to us and say we should be proud of what we created, that motivates us to raise the bar that little bit further each time!" sums up Andreas Herzog.



Ten to twelve hours of challenging machining work has already gone into this component

The Ceratizit tools can negotiate even the tightest curves, thanks to clever strategies

further information: ***www.ceratizit.com***

EMUGE-FRANKEN:

100 years of innovation, precision and proximity

Richard Glimpel founded his precision tool factory in 1920, which later developed to the EMUGE-FRANKEN company group

In *Lauf an der Pegnitz* in Middle Franconia, Richard Glimpel laid the foundation stone for the family business EMUGE-FRANKEN 100 years ago. Always focused on innovative solutions to improve productivity in the machining industry, a group of companies with 1900 employees at 52 locations worldwide developed over the course of a century.

Innovation, precision and proximity are not only the values EMUGE-FRANKEN stands for today, but also characterized the founding years. After working in various positions in German mechanical engineering companies and graduating as a master craftsman, *Richard Glimpel* decided to realize his dreams by founding his own company. On May 20, 1920, he and three employees founded the *"Präzisions-Werkzeugfabrik Richard Glimpel Lauf a.d. Pegnitz (Bavaria)"*, which was transformed into the "Präzisionswerkzeugfabrik Nürnberg-Lauf Moschkau&Glimpel" on July 1, 1920. In the same year, Richard Glimpel invented the single-finishing tap with spiral point. The tap revolutionized the machining of internal threads, as they were no longer produced with a three-part tap set, but much faster with only one tool. A large-scale order from a railway company secured the company's growth shortly after its foundation, but new tool requirements required a new company orientation, the inclusion of partners and a changed company name. This resulted in the brand name EMUGE, composed of the phonetic spelling of the first letters of Moschkau and Glimpel.

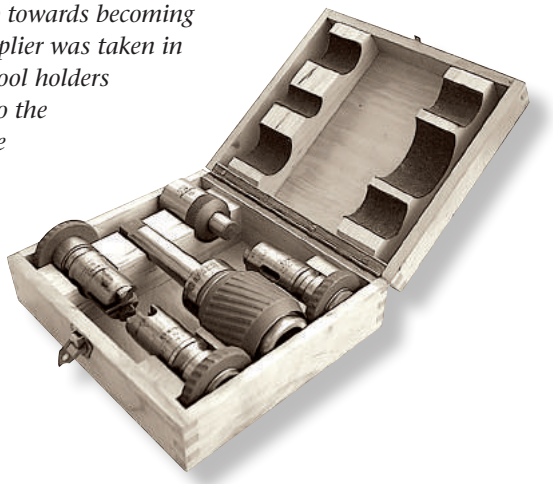
Together with three employees, Richard Glimpel started his tool production in rented premises in the Nürnberger Straße in Lauf

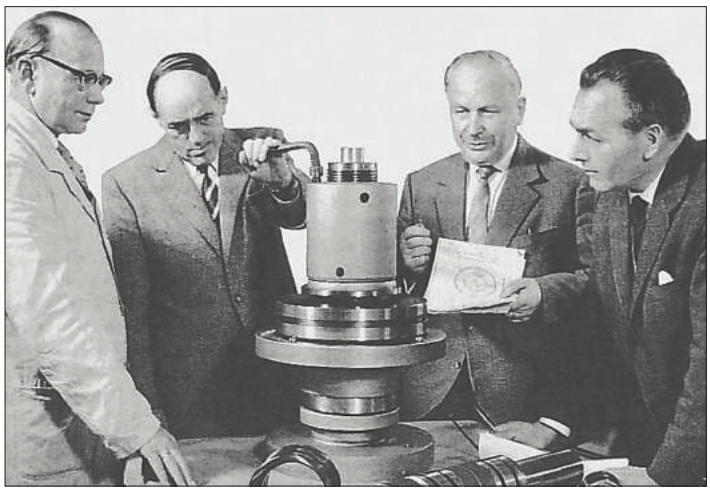
The way to a system supplier

Richard Glimpel was aware that the adjustment of the tool system had a decisive influence on productivity and therefore added tool holders to the product range in 1928 and the *Spieth system* for workpiece clamping in 1950. In 1953, the patent for the steep spiral fluted tap followed, which is still the determining geometry for internal thread machining in blind holes today. *Helmut Glimpel,* son of the company founder and - together with his son-in-law *Gerhard Knienieder* - today's managing director, began his career in the company in 1956. With the acquisition of the company FRANKEN in 1958, the product range was supplemented with milling tools and the foundation stone for a company group was laid. With the addition of new business units, EMUGE-FRANKEN developed into a system

The single-finishing tap with spiral point, which Richard Glimpel developed in 1920, revolutionized machine thread manufacturing with only a third of the production time

The first step towards becoming a system supplier was taken in 1928 when tool holders were added to the product range





In 1950 started the distribution of the workpiece clamping system Spieth

supplier of precision tools for thread cutting, drilling, gauging, clamping and milling technology.

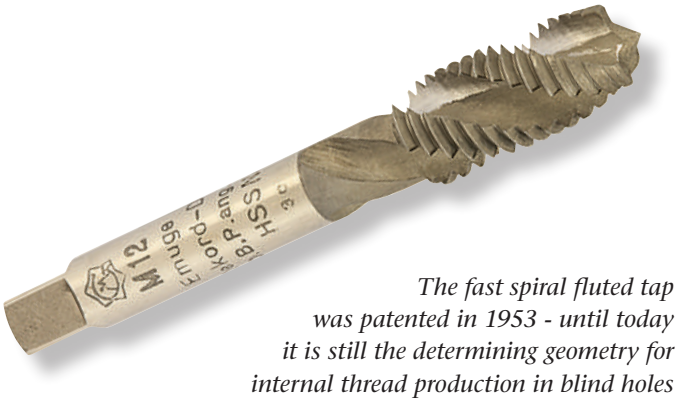
Customer proximity always in mind

"A customer is someone who brings us his wishes. Our job is to fulfill those wishes profitably for him and us." Following Richard Glimpel's credo of customer proximity, his son Helmut Glimpel focused not only on expanding the product range, but also on establishing new sales and production locations. The first foreign subsidiary in the USA in 1983 was followed by further sales offices in all the world's major industrial nations, some of which also have production facilities for the local market. In addition to the sales team, EMUGE or FRANKEN technicians are also available on site. They travel from Lauf or Rückersdorf to any place in the world to support customers with the optimal tool solution. If standard tools are not sufficient for this purpose, the tools are also manufactured according to customer specifications.

With innovations to the future

Innovations characterize the entire century of the company's history. The inventive spirit is reflected in particular in the numerous patents which have been regularly granted since the company was founded and which also include the latest developments such as FRANKEN *Cut&Form,* EMUGE *Punch Tap* or EMUGE *Taptor.* Even for technically more sophisticated thread formers, unique geometry improvements could be realized, as the patent application for the EMUGE *InnoForm Steel-M* shows.

The realization of such milestones shows that the corporate values of innovation-precision-close proximity are also lived. EMUGE-FRANKEN's commitment to develop meaningful solutions together with its customers is reflected in the proximity to the customers and openness for new ideas. Appropriate conditions are also being created for this purpose on the production side. A clear signal is the just beginning construction of an 20,000 m² new building opposite the current company headquarters in Lauf, which will offer new, generous production capacities from 2023. Continuity and long-term orientation of the family business are also guaranteed in terms of personnel - the next generation of the entrepreneurial family is already in the starting blocks.



The fast spiral fluted tap was patented in 1953 - until today it is still the determining geometry for internal thread production in blind holes

Today's company headquarters in Lauf an der Pegnitz in Middle Franconia/Germany

The new building shown on the right will increase the production space by a further 20,000 m² from 2023

EMUGE-FRANKEN

For 100 years, the German company group EMUGE-FRANKEN has been one of the world's leading manufacturers of precision tools for thread cutting, gauging, clamping and milling. With 1,900 employees, EMUGE-FRANKEN offers an innovative product program with 40,000 in-stock items and a multiple of that with customer-specific tools. The product range focuses on applications in the automotive industry, power plants, aerospace industry, medical technology as well as mechanical and plant engineering. As a system supplier for machining industry, EMUGE-FRANKEN has own branch offices or sales partners in 52 countries.

Interview with Gerhard Knienieder, EMUGE-FRANKEN

EMUGE-FRANKEN Managing Director Gerhard Knienieder about precision tools, the advantages of joint developments and the international presence of the company.

From the very beginning, EMUGE-FRANKEN's intention was to realize its own ideas - starting with the single-finishing tap with spiral point. Since then, threading tools and innovations have shaped the company. What is special about threading tools?

Gerhard Knienieder: Threading tools are embedded in the DNA of EMUGE-FRANKEN, from the time of its foundation by Richard Glimpel in 1920 to the present day! Of course, a multitude of technologies have been added in the meantime: as a system supplier for all aspects of internal threads we can offer our customers a well-rounded program including tools for thread forming, thread milling, thread gauges, tap holders and twist drills. Problem solution from one source! Since the 1950s, EMUGE has been synonymous for precision clamping tools and FRANKEN for milling technology.

In contrast to many other types of cutting tools, the special feature of threading tools is that they often perform one of the last machining operations on the almost finished component. Safe and reliable threading is essential to avoid costly rejects with very expensive workpieces, for example in large plant construction or with components made of high-quality materials.

On the other hand, we are constantly working on improving productivity in large-scale production, e.g. in the automotive industry, in order to reduce the cost-per-part for the customer. In this regard, our latest new developments, the EMUGE *Speedsynchro* collet holder and also the EMUGE *Punch Tap*, have created completely new possibilities for saving time. The EMUGE *Taptor* could make its mark in the future. However, its development is not yet complete and it is currently being tested for series production.

What is interesting about precision tools - and thus also about threading tools - is the wide range of application industries: although the automotive industry represents a large customer group, threading tools are needed in almost all metal processing companies, whether in mechanical and plant engineering, aircraft industry or medical technology. Each industry has its own special requirements, which we are happy to meet. This is what makes working with precision tools so exciting! We work on newly developed products and technologies of our customers and thus have always kept pace with the times!

Future-oriented with innovations. The threading tool presented at EMO 2019 is the latest tool for which a patent application has been filed. What is so special about it? And what is the difference to PunchTap technology?

Gerhard Knienieder: The innovative EMUGE Taptor technology integrates two actually separate machining sequences of pre-drilling and tapping into a single process step. The time saving is achieved by eliminating the entire time that the pre-drilling process in itself would take. The Taptor tool is used in conjunction with a special EMUGE Speedsynchro collet holder with transmission gear. This achieves a constant cutting speed in the machining of the hole. In addition, the process time can be further reduced. For example, machining a cylinder head with an M6 thread can save 1-2 seconds.

In contrast to Taptor, the Punch Tap technology reduces the time of movement during thread generation, the pre-drilled operation remains unaffected. The thread is produced by significantly shortening the path of the individual thread teeth through specific kinematics. The machining time for a typical thread can be reduced by up to 75 % when viewed separately. This technology ensures a high process reliability, especially under MQL conditions.

You often develop projects together with customers, in this case with Audi. How do such joint developments take place and what is particularly important? What advantages does this cooperation offer?

Gerhard Knienieder: Ideas for new products can be created in our development department or directly at the customer's site. The best scenario emerges, when both possibilities are closely linked. In this way, customer requirements create immediately specific development steps. In addition, with some product developments we reach the limits of what is currently technologically/physically feasible. This makes it all the more important to clarify the possibilities, e.g. of machine technology on the user side, together with the customer.

Our experience with such development projects is very positive: working with a team of developers, users and production specialists in a creative, open atmosphere is fun, motivating - and has also proven to be highly

productive! In particular, the interdisciplinary composition (including measurement technology, NC experts, machine engineers, machining and assembly specialists - whether from us or from the customer's side) brings all the necessary experts to the table. This turns a sequential into a simultaneous development and saves a great deal of time, which can be important, especially with fixed milestones - e.g. manufacturing start of the production line (SOP)!

EMUGE-FRANKEN is present on the international stage. How important are manufacturing plants abroad?

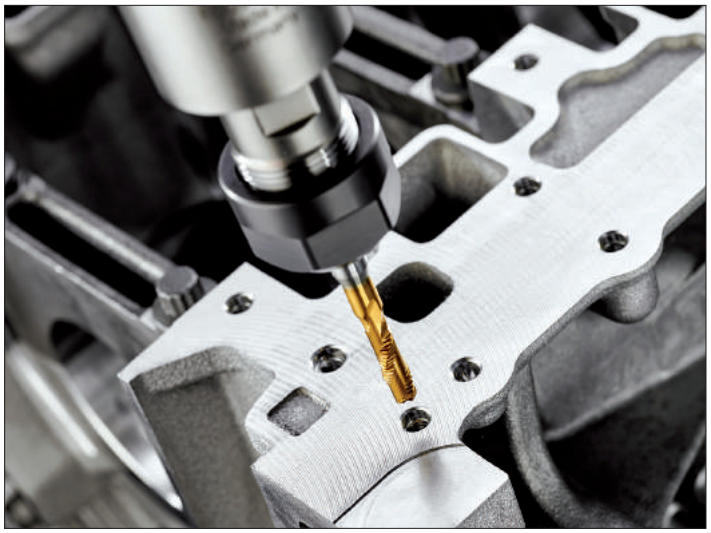
Gerhard Knienieder: Modern logistics enable us to ship our "small" tools "Made-in-Germany" within the shortest time even to the most distant countries. The geographical proximity of a production facility is therefore generally not essential for our international customers. 95 % of our tools are therefore still manufactured in Germany. The only countries where we manufacture taps for the regional markets are India and Brazil due to the high import duties.

Much more important is the competent service of our EMUGE-FRANKEN sales and service team in the individual countries.

The focus of our internationalization over the past decades has therefore been the establishment of over 50 EMUGE-FRANKEN subsidiaries/partner companies in all important regions of the world. This enables us to support our customers with well-trained specialists.

In Austria, China and North America, formerly exclusive resharpening centers have meanwhile developed into important manufacturing plants for special tools made of solid carbide. However, it is not threading tools that are resharpened there, but primarily milling and drilling tools. Customer proximity combined with specific requirements - especially in the USA and China - have supported this positive development in recent years.

The patented Franken Cut&Form end mill enables finishing and polishing of the workpiece in one operation



The Punch Tap technology enables internal thread production in a quarter of the time

The entrepreneurial family today: Thomas Pompe, Cornelia Glimpel-Pompe, Helmut Glimpel, Ulrike Glimpel-Knienieder, Gerhard Knienieder

further information: ***www.emuge-franken.com***

Comprehensive further development

Process-reliable face milling with a long tool life

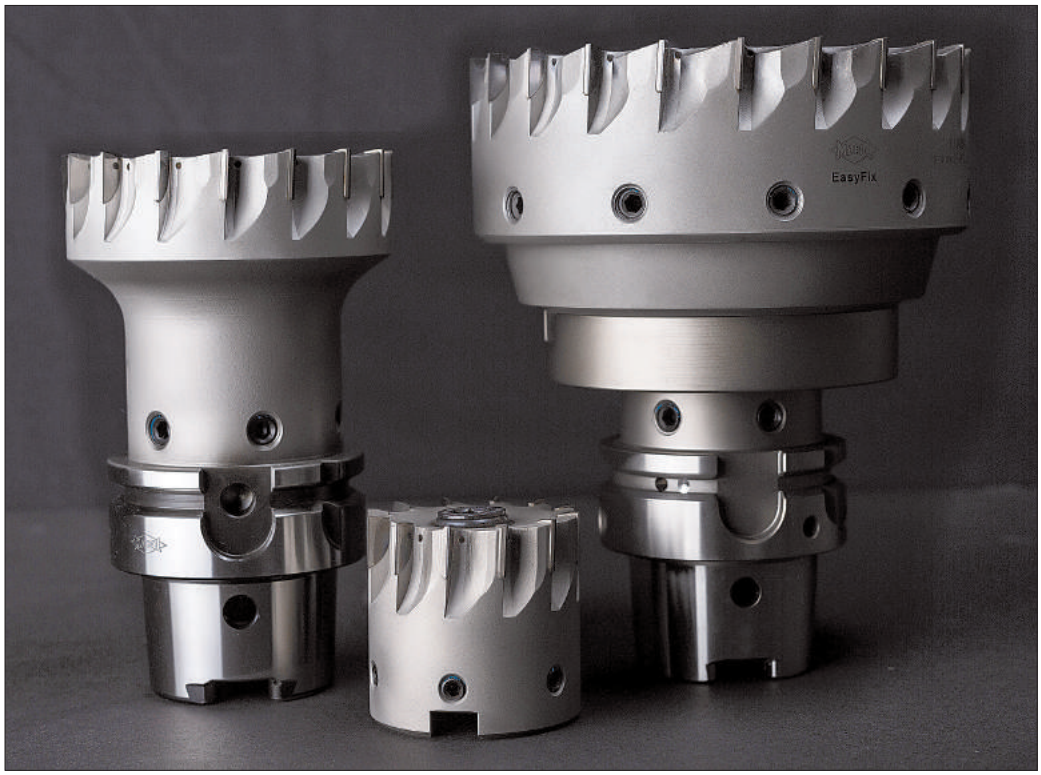
MAPAL customers rely on the *FaceMill-Diamond* PCD face milling cutter for face milling work at high volumes, on unstable parts and in the HPC (high performance cutting) sector. With its solid steel tool body and the permanently brazed PCD cutting edges, it achieves top feed rates and material removal rates that are second to none. Following comprehensive further development, MAPAL has increased the productivity of the PCD face milling system once again.

"Particularly in the area of high performance cutting, the number one customer requirement is the achievable material removal rate alongside the best possible component surface," reports *Andreas Wittenauer,* Head of Application Technology in the PCD Tool division. He goes into more specific details by adding: "For this reason, the FaceMill-Diamond features an exceptionally high number of permanently brazed cutting edges for its diameter. The cutting edges are designed for a cutting depth of up to 10 mm. Furthermore, the robust tool body absorbs the vibrations generated during machining and prevents damage to the component surface." Also the FaceMill-Diamond can be inserted directly into the machine when newly equipped - without time-consuming adjustment work requiring operator expertise. Based on this, MAPAL further developed the PCD face milling cutter in two ways in 2019, increasing its potential for further productivity.

A longer tool life and improved chip removal thanks to coolant outlets directly at the cutting edges

"High cutting values and the resulting chip volume may, under certain circumstances, lead to washout of the tool body. To counteract this effect and maintain an economical product life cycle, we have optimised the cooling concept and positioned the coolant outlets directly at the cutting edges," explains Andreas Wittenauer. "This ensures improved chip removal and protects the tool body, especially for applications with minimum quantity lubrication or air cooling."

A direct compare with the new generation of the FaceMill-Diamond and the previous model provides the specific improvements. A customer machines a part made of AlSi1 with cooling lubricant on a machining center. The application parameters of the 63 mm diameter milling cutter have deliberately been left the same for the comparison: a cutting speed of almost 3,000 m/min and a spindle speed of 15,000 rpm. Due to the high-gloss surface requirement, the feed per tooth is 0.04 mm and the cutting depth is 0.8-1.2 mm. "The customer was delighted with the new tool right away," says Andreas Wittenauer. "The surface it achieves is noticeably higher in quality and it removes the chips more effectively. We are pleased that we were able to increase the tool life by 15 % with the new FaceMill-Diamond, and that the customer is now successively converting their entire inventory."



Even more economical and flexible to use - MAPAL has further developed the FaceMill-Diamond

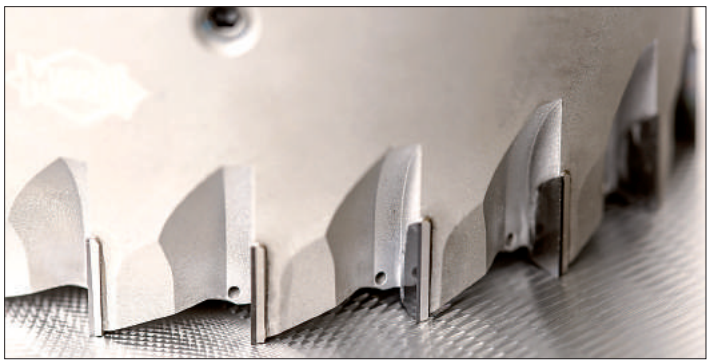
Modular variant provides greater flexibility

Customers with a diverse range of machinery want a certain degree of flexibility as far as tool use is concerned. In order to meet this demand, the FaceMill-Diamond is now also available in a modular version with a milling head. Andreas Wittenauer provides us with more details: "The modular version of the FaceMill-Diamond can be used flexibly - particularly for small series production and machinery that uses different interfaces, or even for large series where production is initiated on one machine and then continued on another."

In the context of a customer project, the modular version offered improvements for both the surface and the cycle time compared to the competing tool used previously. With a spindle speed of 12,000 rpm and a feed per tooth of 0.1 mm, the machining tool variant of the FaceMill-Diamond mills about three seconds faster than the previously used tool. As such, the quadruple mounting on the machine results in a saving of twelve seconds in the cycle time.

Optimised wheel carrier machining: tool life exponentially increased from 3,000 to 40,000 parts

The FaceMill-Diamond is used not only in the standard variants available, but also as an individual specialised solution, as demonstrated in the machining of a wheel carrier made of AlSi12 (T4) on a machining center. The employees responsible for the process complained about the use of a face milling cutter in the original process. With the competing tool that was used originally, the high cutting values required for cycle time reasons combined with the stock removal led to process-critical burr formation. Specifically, the chip was bent at 90° on perimeter of the part and was not cut, being instead retained as a so-called burr flag on the edge of the part. Several challenges became apparent in our first conversation with the customer. Andreas Wittenauer: "The heat-treated part has a strong tendency to vibrate and the hard chips wash-out the tool body. On top of that, several milling operations



With the further developed FaceMill-Diamond, customers achieve the best surface qualities

are required at different positions on the part - the stock removal is up to 7 mm axially and up to 3 mm radially."

The specialists at the Centre of Competence for PCD tools settled on a combined special cutting edge geometry in order to meet all the requirements provided. At the unchanged cutting values of a feed rate of 15,400 mm/min and a spindle speed of 7,000 rpm, the tool life was increased exponentially: the FaceMill-Diamond now reliably mills 40,000 wheel carriers, contrasting with the previous output of 3,000. Today, our customer has 16 FaceMill-Diamonds in circulation in order to machine their annual production quantity of 600,000 parts.

information: **www.mapal.com**

High performance in aluminium and steel

Milling from solid

High infeed depths as well as the highest feeds during roughing are possible with the new OptiMill-SPM-Rough. The reason for this performance is its innovative knurled roughing geometry that ensures the power consumption during machining is significantly lower compared to tools with a straight cutting edge. Furthermore, the heat introduction into the part is minimal due to the excellent plunging characteristics of the tool.

Rough by MAPAL.

For finishing contours and pocket walls - even at large depths in one pass - MAPAL is announcing the OptiMill-SPM-Finish with newly developed geometry. It operates without problems even with large wrapping - also in the corners with enormous tool contact and a high load, the tool remains stable. The optimally designed cutting edge geometry ensures there is no vibration during the machining. The chip flutes are polished; as a consequence chip removal functions optimally.

Optimal for slot milling in steel

The OptiMill-Uni-Wave is the tool of choice if the issue is full slot milling with a groove depth of up to 2xD in differ-

MAPAL is expanding its portfolio in the area of high-performance milling cutters in the OptiMill family with the models (from left) OptiMill-SPM-Rough, OptiMill-SPM-Finish, OptiMill-Uni-Wave extra long design and OptiMill-Uni-Wave with internal cooling

ent materials. Due to its geometry, the highest machining rates are possible. Irrespective of all the advantages of the OptiMill-Uni-Wave, machinists often faced the difficulty that chip removal was not reliable, particularly in steel materials during the machining of slots with a depth ≥ 1.5xD. For this reason, MAPAL now offers the OptiMill-Uni-Wave also with central internal cooling. In addition, MAPAL is announcing the OptiMill-Uni-Wave as an extra long version.

information: **www.mapal.com**

ARP - high accuracy round insert cutters

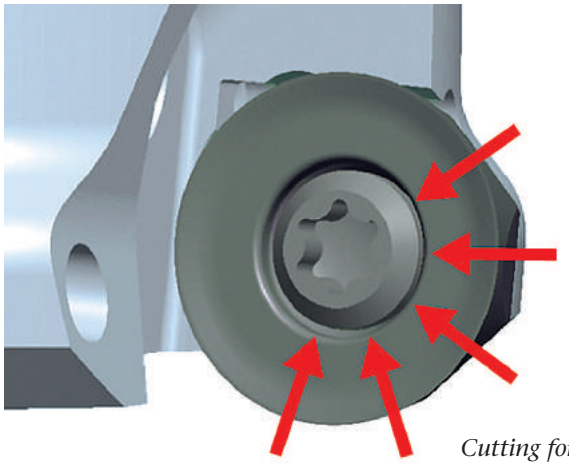
Significant cutting force reductions

For machining difficult-to-cut materials with a high level of accuracy and efficiency, Mitsubishi Materials has expanded its ARP series of round inserts, high runout accuracy milling tools.

ARP is ideal for machining titanium and other heat resistant alloys as well as stainless steels that are commonplace in the aerospace and power generation industries. The ARP series has delivered tool life improvements and significant cutting force reductions compared to other products.

Accuracy and strength

These significant gains have been achieved by developing an extremely accurate insert seat pocket that improves radial runout accuracy by 25% compared to conventional products. This also realises minimal change of run-out accuracy when indexing the inserts. Furthermore, ARP tool bodies deliver an exceptionally strong seating configuration that has two side location faces to prevent inserts from moving during cutting. This robust positioning is complemented by an innovative insert geometry design that has a special rake face to generate smooth chip flow and reduce cutting resistance. This development creates an even chip flow and directs the cutting forces towards the center, the strongest part of the insert pocket.



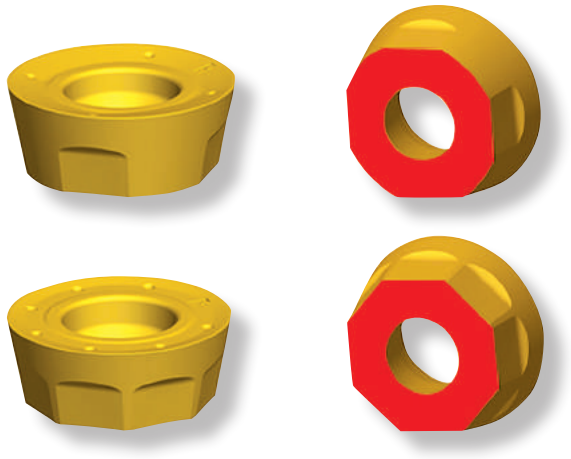
Cutting forces directed towards the center

Additions

A new grade and type of insert have been added to the range with eight side seating faces that are ideal for use at lower depths of cut and can effectively double usage of the insert. The range of the traditional four side seating face inserts has also been expanded. These new inserts have an improved structure with a wider core and thickness to help combat sudden fracturing under heavy machining conditions. A new addition added to the range is MP9140, a new PVD coated carbide grade. Combining a smooth top surface of the Al-rich AlTiN coating layer, and a special cemented carbide substrate, makes MP9140 ideal for machining titanium and heat resistant alloys. In total, there are four different high performance grades that can be combined with several different chipbreakers to optimise the choice and cutting performance for a wide range of light, medium and roughing applications.

New inserts with a wider and thicker cross section

The ARP series is available with cutter bodies that include shell types Ø 40 to 100mm. These bodies offer course, fine and super fine insert pitches with a choice of four to eleven inserts per tool depending upon the selected diameter. For machining smaller surface areas and intricate forms, Mitsubishi also includes a shank type tool that is available in standard and long lengths for processing difficult to reach cavities and forms. These standard and long reach tool bodies are offered in Ø 25, 32, 40 and 50mm with two to five inserts to meet a vast range of machining applications. In addition, versatile screw-in type tool bodies in Ø 25, 32 and 40 are also available.



Optimum choice of four or eight positioning faces prevents rotation during machining

information: **www.mmc-hardmetal.com**

Precision and reliability

Innovative and economical inserts

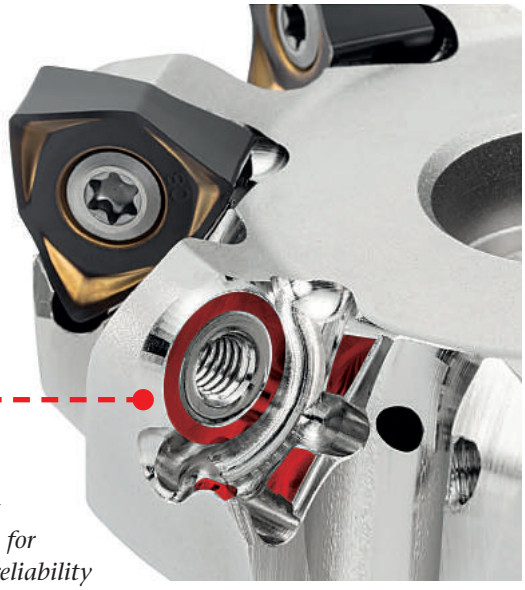
Mitsubishi Materials has added a versatile indexable insert milling cutter to its extensive range of high performance tools. The new *WWX400* is a series of true 90° corner milling cutters for face, shoulder and copying applications. Featuring economical double-sided trigon inserts with six cutting edges, WWX400 has been designed to meet all the needs of the modern metal cutting industry.

The innovative and accurate geometry of the insert pocket, together with precise locating of the inserts on the tool body, ensures that a true 90° wall can be machined on components. In most cases, this eliminates the need for secondary finishing operations, thereby saving valuable production time and costs. WWX400 cutters can perform at high feed rates to ensure usability and efficiency across a wide choice of applications. The body features four contact faces inside the insert pocket, plus the use of a large screw, that provides high insert clamping strength and stability without compromising accuracy. This means it can be used for semi-roughing as well as for finishing operations. To further enhance usability and dependability, each body has internal through coolant channels to supply high pressure cutting fluid directly at each insert.

Innovative and economical inserts

The unique carbide inserts feature six usable cutting edges that offer lower costs and excellent process reliability thanks to a negative seating geometry but provide a positive sharp cutting action. This generates low cutting forces and together with an increase in insert thickness compared to conventional types, also provides excellent resistance to breakage. Furthermore, a high maximum depth of cut of up to 8.2 mm enables efficient shoulder milling capabilities. In order to meet component surface finish expectations, the bottom of all inserts feature a large radius geometry that acts like a traditional wiper.

Three different chipbreakers are available, the L, M and R breakers for light, medium and rough machining respectively. These can be matched with an extensive selection of eight different coated and uncoated carbide grades, providing choices that ensure that the ideal combination can be chosen to effectively machine a wide range of materials.



information: **www.mmc-hardmetal.com**

All round turning grade CTPX710 unveiled by Ceratizit

Usability of one grade for many material groups

Cutting Solutions by CERATIZIT a product brand of *Team Cutting Tools* has introduced its latest grade for turning, CTPX710, which is set to reform insert choice for customers. Developed as a multi-application grade utilising new coating technology and new carbide substrate, CTPX710 now means one grade can be used across many material groups from super alloys to general steels and non-ferrous materials. The result is reduced tool inventories and simplified tool-changing for machine operators, with just insert geometry changing to suit specific materials, the grade remains the same.

The success of CTPX710 is the unique partnership between the carbide substrate, the latest *Dragonskin coating technology*, which are then enhanced by a secondary finishing process after coating. The new substrate is a fine-grain carbide with an optimised microstructure that provides a hard, wear resistant base onto which the Dragonskin coating is applied. For CTPX710 inserts the coating thickness has been increased, which provides additional damping/shock absorbing effect to further protect the substrate. During manufacture, once the coating has been applied, the inserts are then subject to a further finishing process to create the smoothest surface possible across the insert geometry and enhance chip flow. It is this combination that enables CTPX710 to be applied across such a diverse range of materials, while delivering improved cutting performance and process security.

"The arrival of CTPX710 means that customers only need one grade of carbide to cover the vast majority of the work they will be undertaking. This is especially important for the large numbers of small to medium sized sub-contract machine shops that take on a diverse range of work; they can now reduce tool inventories in the knowledge that they have an insert grade that will handle all of the materials they may be faced with," says Adrian Fitts, Business Development Manager, Ceratizit UK & Ireland. "While the all round performance of CTPX710 is unquestionable, we are finding it delivers excellent results when machining stainless steel and duplex and super alloys, and this is of particular interest to many customers in the UK and Ireland."

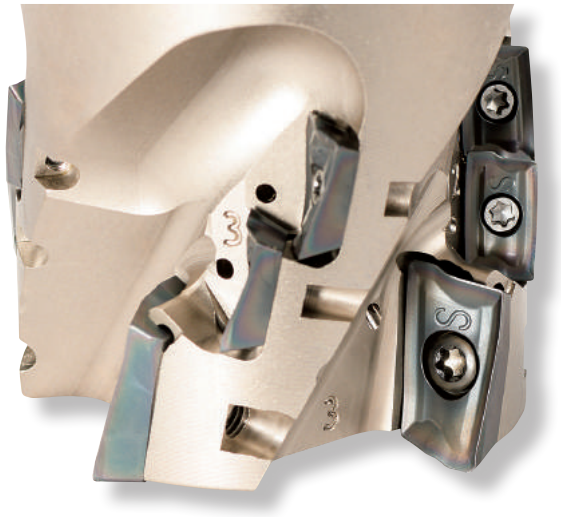
For the machining of steel, stainless steel, superalloys and non-ferrous metals users only need the multi-application grades CTPX710 or CTPX715 from CERATIZIT

CTPX710 inserts are available in a wide variety of standard ISO insert shapes, with three insert geometries available, these being -M34 which is aimed at turning super alloys due to the low cutting forces it generates along with its resistance to built-up edges; for non-ferrous, steels and cast iron there are two available geometries -25P and -25Q, the former having a sharp cutting edge providing good swarf control on softer materials, while the latter features wiper technology to deliver higher feedrates and improved surface finish.

information: **www.ceratizit.de**

New helical end mill for titanium alloy machining

New range of indexable milling cutters



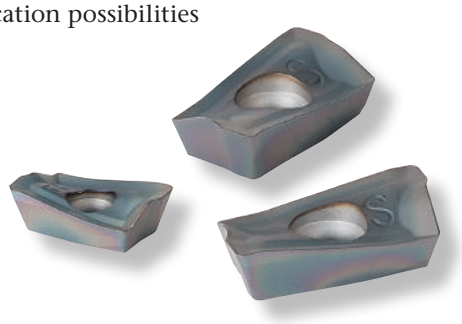
Kyocera expands the MECH product line to provide more stable performance and longer tool life. The Japanese fine ceramics manufacturer Kyocera presents its latest innovation: MECHT enhances the range of indexable milling cutters. Due to its ideal tool geometry, MECHT is ideally suited for applications in shoulder face milling, plunge cutting and slot milling as well as ramping. Like the entire MEC series from Kyocera, MECHT features positive and very light-cutting, which achieves perfect 90° shoulders and smooth surfaces.

Unique design offers obvious benefits

Compared to conventional milling cutters in this category, the Kyocera product is characterised by a new combination of insert sizes. The larger bottom inserts are positioned at the first stage of the toolholder to handle larger cutting forces and higher cutting forces. This stabilizes the titanium alloys machining and improves the fracture resistance significantly. At the same time, the innovative design ensures higher reliability, as the bottom inserts are held in place by double-faced contacts. Another advantage: the new flute design (large, smooth) prevents the chips from clogging. Thanks to this combination, MECHT reduces not only chattering issues but also renewed chip recutting issues.

Longer tool life ensures stable and constant performance

In addition to the advantages of the new tool design, the new Kyocera milling cutter is also more durable due to its conditions. The JS chipbreakers require a significantly lower cutting force than other cutters. Due to this extremely sharp cutting performance, heat development at the cutting edge is kept to a minimum - which, again, ensures a long tool life. Furthermore, MECHT was developed with heat-resistant MEGACOAT NANO coating technology. The tough PVD-coating (PR1535) increases the breaking strength of the product and the stable and long-lasting application possibilities as well.



Features MECHT

toolholder lineup:	end mill type	32 mm
	shell mill type	50 - 80 mm
insert size lineup:	11, 17 mm	
corner radii:	R 0.2, 0.4 and 0.8 mm	

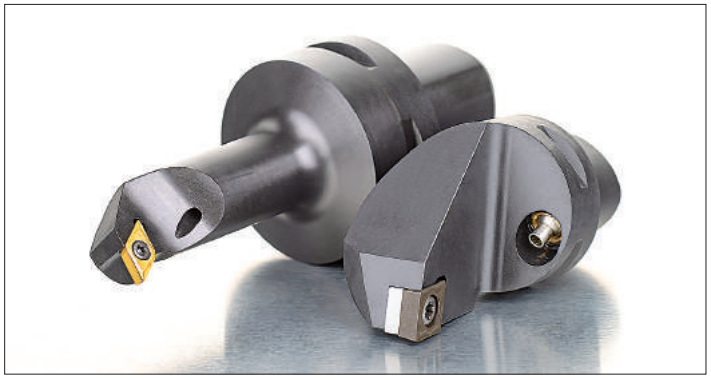
information: ***www.kyocera.com***

New tooling system provides speed and accuracy

Usable on multi-task machines

Dormer Pramet has launched a high precision, quick-change tooling system for a variety of internal and external turning applications. Ideal for use on multi-task machines, the polygon shank coupling (PSC) is a spindle interface which promotes higher productivity through reduced set-up time and faster, more precise machining.

It achieves this with a unique tapered polygon cone shank and flange surface, which supports a high degree of rigidity. With an accuracy in X, Y, Z directions of +/-2 µm, the PSC holders provide a high level of repeatability. In addition, a reduced overhang length minimises vibration and runout inaccuracy for a high-quality surface finish, making it ideal for aerospace and general machining applications.



The polygon shank coupling (PSC) is a spindle interface which promotes higher productivity

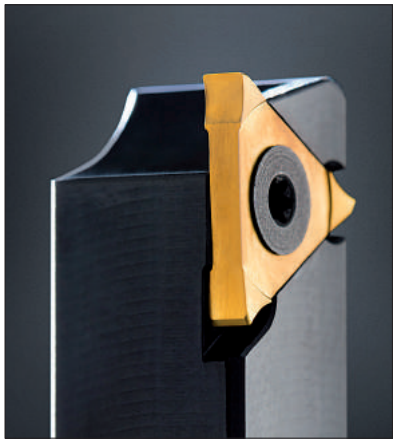
Connected by a triangular conical structure and cross section, which uses 1/20 taper, the PSC features internal coolant channels and a steel toolholder for high toughness. More than 130 different items are available, including a variety of tool holder styles, internal tools, interface types and shank sizes.

information: **www.dormerpramet.com**

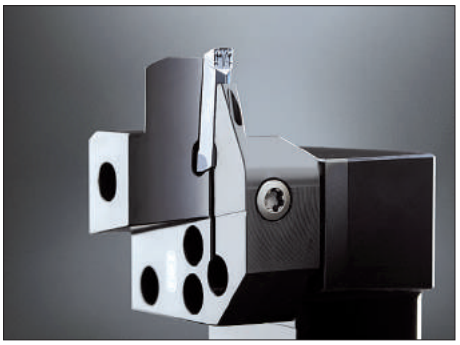
New 32T grooving system

Paul Horn GmbH has developed the new 32T system for use on Swiss-type lathes and for grooving and parting off on smaller fixed-head lathes. The tool manufacturer is expanding the tool system by introducing versions for threading, grooving and longitudinal turning as well as for full radius grooving.

The central clamping screw offers high changeover accuracy of the cutting insert and direct entry into the insert seat of the tool holder. Additionally, there is no need for clamping elements, which could potentially have a detrimental effect on chip flow. The head of the clamping screw does not introduce interference contours and therefore permits both grooving and parting off directly at the spindle. The precision-sintered grooving insert can be used as a neutral insert and as both a left-hand and a right-hand insert. The 32T system completes Horn's portfolio of triple-edged cutting inserts by offering a solution for smaller-scale applications.



The 32T system completes Horn's portfolio of triple-edged inserts by offering a solution for smaller-scale applications



To accommodate axial grooving operations with diameters ranging from 38 mm to 1,000 mm, Horn is now offering new holder variants for the S224 grooving system

S224 face grooving system

To accommodate axial grooving operations with diameters ranging from 38 mm to 1,000 mm (1.496" to 39.370"), Horn is now offering new holder variants for the S224 grooving system. The tool manufacturer is extending its modular concept so that various types of cartridge can be clamped using a single base holder. The internal coolant supply allows direct cooling in the contact zone while simultaneously increasing tool life. In addition, the high coolant pressure ensures improved chip removal from the groove. Thanks to the wide range of chipbreaker geometries and substrates available with the S224 double-edged system, the tool system can be easily adapted to the machining task as well as the material to be machined.

information: **www.phorn.de**

When time is what matters

Corrosion resistant tool holder grade

With *Uddeholm Idun,* the tool holder market is revolutionized, by offering a safe and reliable fast forward button to finished tool holders for indexable inserts. Uddeholm Idun is a pre-hardened and corrosion resistant steel grade, which makes the production a one-stop-shop where heat treatment and coatings will no longer be necessary.

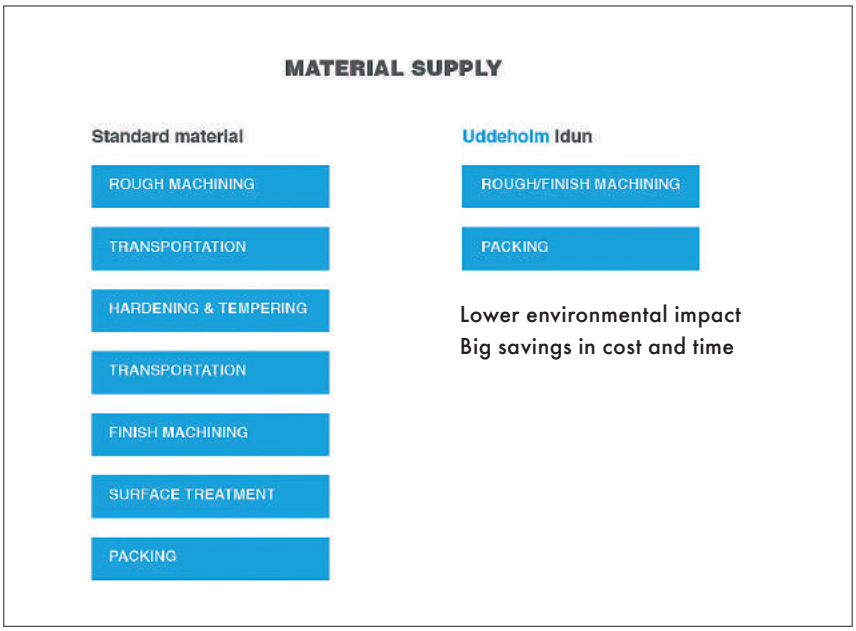
In today's market, time is of the essence for tool producers. Recent years have seen an increasing trend in machining more tools in hard condition, not only to meet the market demand and shorter delivery times, but also to save both time and money on less heat treatment. Naturally the next step to further decrease the production time is to dispose of costly and time demanding coatings. Until now this has not been possible. Uddeholm Idun changes this by being the first patented corrosion resistant tool holder grade on the market.

Corrosion resistance is requested both for its pleasing aesthetics, as well as to protect the tool holder from corrosion attacks. Uddeholm Idun has undergone comparison tests in a salt spray chamber according to SS-EN ISO 9227 in 0.1M salt solution at 35° C for 3.5 hours. The steel showed no corrosion, which proves that the corrosion resistance is at least in parity with nickel coating or better.

Uddeholm Idun is meeting the market demands by being pre-hardened to 42-46 HRc, a hardness range used for milling cutters. The steel is manufactured by electro slag remelting, which gives it an even microstructure with small carbides in a martensitic matrix. The hardness is even from the surface to the center. Although delivered in hard condition, Uddeholm Idun still offers good machinability. If wear resistance needs to be improved locally Uddeholm Idun can be induction hardened to 55 HRc on the surface.

Uddeholm Idun has much better softening resistance than standard P20 type materials at a constant temperature of 450° C and it keeps a high hardness at 500° C for a long time. Competing materials tend to get a soft surface due to the temperatures created when in production. When losing the surface hardness, the function of the steel is lost of course.

- starting material from recycled steel scrap
- corrosion resistant steel, no need for nickel platin
- delivered in pre hardened condition, no need for heat treatment
- no need for transportation for heat treatment and nickel plating



information: **www.uddeholm.com**

LACH DIAMANT looks back on 98 years - fourth part

Poly - poly - or what?

How a Trade Show initiated a brilliant idea...

Horst Lach, managing director and CEO of LACH DIAMANT agreed to write an ongoing series of articles about the development of diamond and CBN tools and grinding wheels in modern industries.

Horst Lach is known as a true industry veteran, and we are excited to have this pioneer of technology share some insights from over 59 years of professional experience in the diamond tool business.

In this forth part of this (almost) historical review, Horst Lach recalls a brilliant idea.

Between 1974 to 1976 polycrystalline cutting materials - diamond (PCD) as well as CBN (PCBN) - could show their potential for the first time. As a result of the hardness of diamond combined with the sharpness for machining tasks, the superiority of PCD was displayed early on:
turning - milling - drilling - cutting.

Nevertheless, this particular cutting material was at that point still a niche product. The world of global players within the automotive industry had not yet discovered it - or had not yet realized its cost-cutting potential. There were several reasons for this.

When the polycrystalline diamond was first introduced to the industry in 1973, tool manufacturers had only been able to grind carbide, a similar cutting material, efficiently, in example in a cost-effective way, for about five years. And again, diamonds - to be more exact - the grinding wheel that was available for carbide cutters at the time played a role in this.

Until around 1967, diamond wheels were only referred to as polishing wheels, and therefore not suitable for pre-grinding processes. The reason for this was that the synthetic and natural diamond grains in resin-bond grinding wheels would fall out of the bond after approximately one third of their product life.

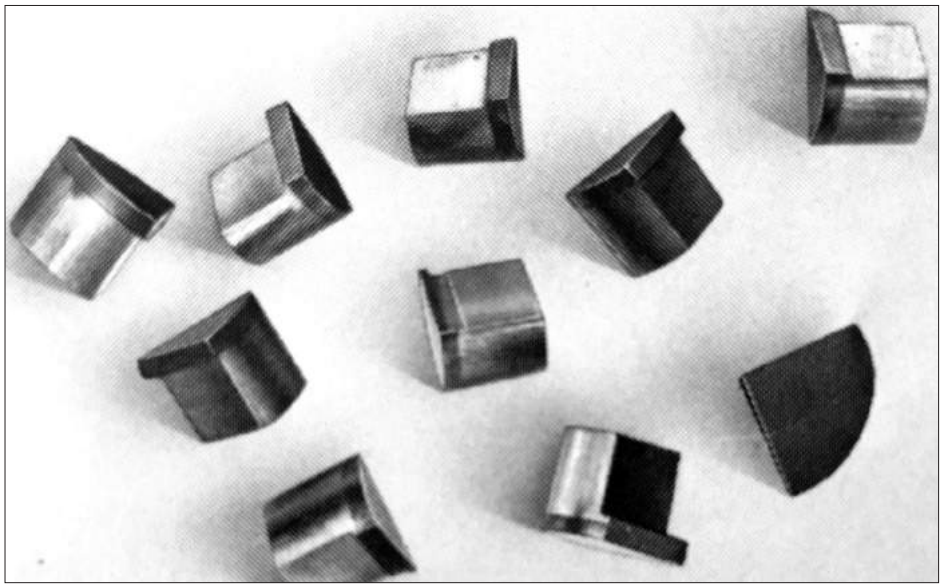
Only after the diamond grains were coated with nickel cobalt, an innovation of the company *Asea*, was it possible to create a lasting, coralline surface connection between the resin bond and the individual diamond grains. Pre-grinding of carbides was now possible and initiated a boom-like upswing of the carbide industry. It could be questioned whether polycrystalline cutting materials came too early (for the industry).

PCD - too early for many

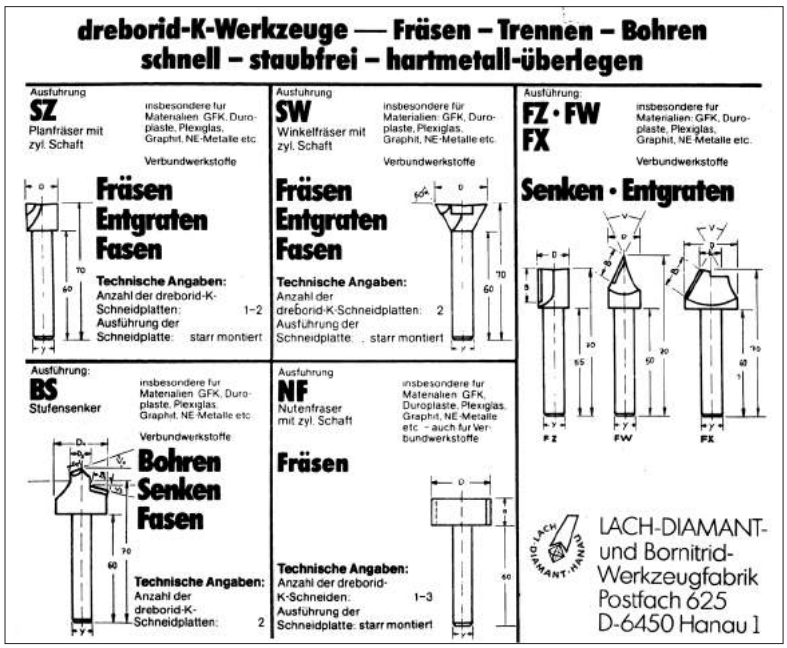
In this regard, in the beginning of the 1970s, turning machines with microprocessors for CNC production did not exist yet. First attempts were made about 1978. Until then, turning was mostly done manually - outside of a few exceptions with perforation stripe controls.

For the carbide industry, especially for the booming manufacturers of carbide tools, the synthetic and at that time still controversial diamond material PCD definitely came too early.

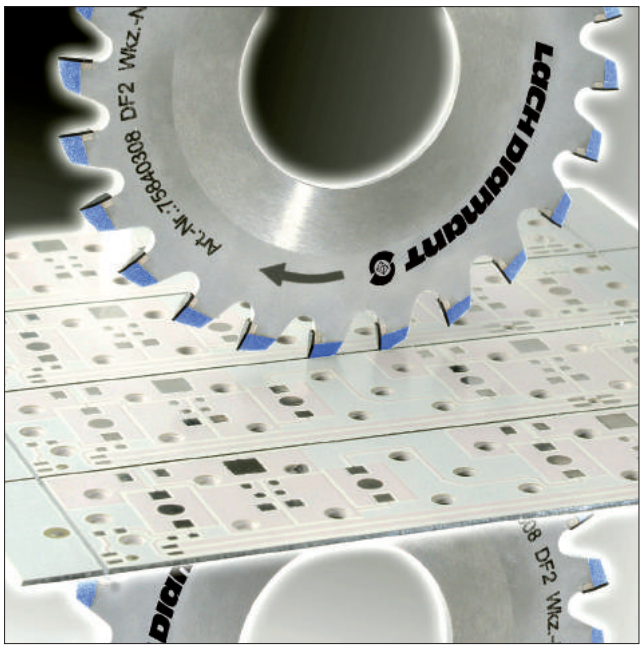
In the early 70s to mid 70s the question was, what to do with a cutting material advertised by manufacturer General Electrics as a *performance-enhancing material for machining non-ferrous metals*. The "hard metal" cutting material had only recently been "defeated". On top of that, non-ferrous metals - where were the potential customers asking for a cutting material for machining of aluminium, superior to carbide and with a much longer tool life? At that time there was no automated production - microprocessors were not introduced into the world of machining until 1978, with one of the first turning machines. The material aluminium had to wait some time until its successful breakthrough into the world of motor manufacturing, in other words mass production of automobiles.



Unmachined synthetic cutting inserts - developmental status as of 1973; the shown segments with 60° and 90° angles were mechanically cut out of PCD blanks (of approx. Ø 3.4 mm) with diamond cutting wheels



Excerpt from catalogue "Trennen, Fräsen, Entgraten, Bohren von GFK, Duroplasten und anderen Werkstoffen mit PKD-Werkzeugen", published on the occasion of productronica 1977 - in the beginning, the schematically shown shank tools could only be fitted with segments from approx. Ø 3.4 mm circular blanks



LACH DIAMANT "DreboBlueCut" scoring saw - development status as of 2018 - "World Running Champion" not only during PCB machining but also (as shown in photo) during the scoring of aluminium IMS circuit boards

Not only the grinding of natural diamonds was "complicated" but also, and even more so, the grinding of "non-growing" polycrystalline diamonds. Therefore, the diamond experts were expected to deal with this "exotic" PCD.

This is more or less how it could have happened that we at LACH DIAMANT concentrated more and more, and with increasing interest, on this new cutting material. Due to our decades-long experience in manufacturing and service of turning tools, made of natural diamonds, for overturning copper commutators, for customers like Bosch, Siemens and AEG, we were made aware of manufacturing problems during the production of raw commutators - and the solution found in PCD.

PCD tools had been developed based on the earliest requirements, and focused on the use of turning tools with soldered cutting segments with 60° or 90° angles.

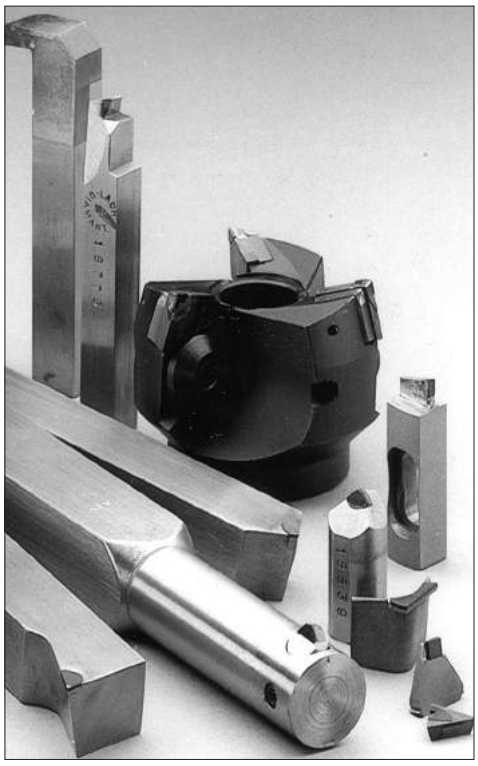
Even though milling with PCD was already a highlight of the *Hanover Trade Show* in the spring of 1974, it was until the end of the 70s limited to carbide plates, which were clamped into cutter heads. They consisted of a soldered PCD cutting edge and small shank tool with at the most three cutting edges.

We have to consider that all then available PCD cutting edges had to be tediously cut out of Ø 3.4 mm, or at the end of the 70s, Ø 6.4 mm blanks - which left only little scope for spectacular depth or width of the cuts. Furthermore, the prevailing textbook opinions about diamonds were still in too many heads during this phase: "Diamond is only suitable for polishing gold and silver and some non-ferrous metals - but by no means suitable for uninterrupted cuts". Another obstacle during the market launch of polycrystalline cutting materials.

Convincing at *productronica*

Of all things, the announcement of a show, which was until then unknown to me, in hindsight proved to be a turning point for the implementation of polycrystalline diamond tools. The productronica, 1977 in Munich, announced as a component show for the electronic and circuit board industry.

I was interested. "Circuit boards? The basic material is glass fibre reinforced plastic (GRP), something we know." We had successfully cut this with PCD - even dust-free.



Soldered PCD mount of external and outer turning and boring as well as for cutter heads

In order to demonstrate this successfully at the trade show, a demonstration machine was needed. We found it at former AEG in Seligenstadt where they manufactured circuit boards for domestic use: a swiss machine from the manufacturer *Amacher*. Three processes could be shown on this small precision machine, type HAMBA: cutting - scoring - edge machining. Excellent. We registered for the show. We placed an internal work order for the three PCD tools or rather saws we needed.

The only objections were raised by production: "How are we supposed to grind these rotating tools - it will take forever…". Indeed, for example, to finish 12 teeth it actually took 35 hours of grinding time! But I thought - and I said it too - "You can do it - you always found a way in the past".

1977 at productronica in Munich - the first presentation of PCD tools for composite machining generated a great deal of interest

The productronica 1977 was at first a huge success for LACH DIAMANT, at that time there was a growing demand for electronic circuit boards, and all the big names were present and gathered around the small *Amacher* machine to marvel at the precise, highly accurate and dust-free machining of PCB, the basic material of circuit boards.

I still remember to this day the doctors of Siemens and NCR who immediately thought of diamond saws for packet machining of Ø 300 and 350 mm, and who spontaneously ordered samples for further experiments.

It could have been so perfect. Machining of circuit board materials would have already been possible in a more efficient way since 1977, if… yes, only if the following would not have happened: "Boss, we really do everything for you, but we can only do one thing - either we can try to make scorers and saws for circuit boards, or we can continue to serve customers like Bosch and Kautt & Bux with commutator diamonds."

That was it for rotating PCD tools. The "grinding" technology delivered only 12 PCD teeth in 35 hours; the facts were very clear. The initial trade show success was gone. During the fol lowing twelve months, I per sonally had a very unpleasant task. The doctors or expert visi tors at the trade show were really "hot" for this technology that had been successfully demonstrated. They assailed me with complaints that we were depriving them of this technology, for whatever reasons. In short: they were miffed.

1977 at productronica in Munich - the worldwide first demonstration of PCD cutters, saws and scoring saws for PCB circuit boards on an Amacher precision machine, type Hamba

In reality, the only culprit was this beastly polycrystalline "non-growing" diamond material itself; even diamond cutters with years of experience capitulated. Again and again we pondered how we could get results faster and and how to conquer this seemingly invincible stuff.

The turning point

And suddenly, at the end of 1978, a second turning point which would finally lead to success. Once again via an announcement, this time as a sales advertisement for a spark erosion machine by the company MATRA in a Frankfurt newspaper.

Never heard of it. Spark erosion machine? But I did remember my father mentioning that electricity played a role during the cutting of natural diamonds on the obligatory cast discs.

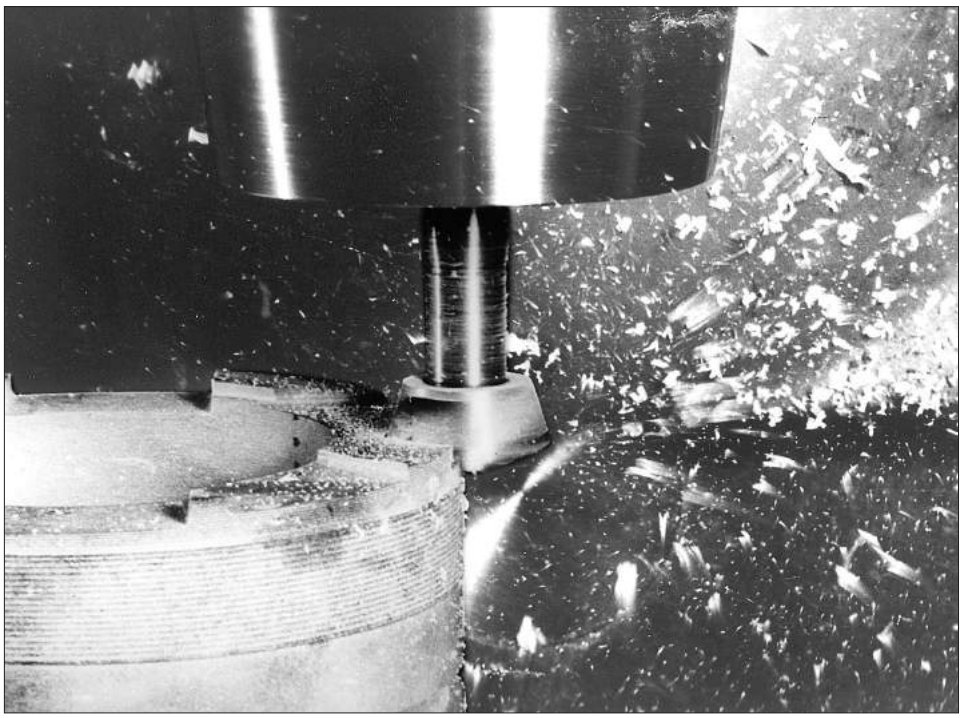
We had a good relationship with MATRA Frankfurt, at that time a manufacturer of "state-of-the-art" surface grinding machines. LACH DIAMANT was allowed to use these machines especially for experiments with CBN Borazon grinding wheels. "So, what" - I said to Gerhard Mai, our newly appointed master of PCD

production, a former diamond cutter, trained at LACH DIAMANT. "Let's take a look at this..."

We quickly made an appointment with the two gentlemen in charge at MATRA, Mr. Schreiber and Mr. Becker. "Yes, stop by with your extremely hard-to-grind carbide, we will see what we can do...". A good thing that we had knowingly kept quiet about the fact that our so-called hard metal was PCD.

I clearly recall how Mr. Becker greeted us at the entrance and led us into a hall with rail access. Left and right of the entrance were some for me at the time un-identifiable machines.

We stood in front of a machine that I would call some sort of "sinking machine". The PCD sample we handed over for the "spark test" was carefully mounted and disappeared in a "brew" which I now understand as a sort of dielectric. The power was switched on. I could tell from Mr. Becker's face that he expected our PCD to show a reaction. We took turns to examine the changes with a magnifying lens. Nothing happened - not even during the next five minutes. "Well, I am sorry, apparently nothing works with this carbide..." they said regretfully.



Chip generating PCD milling of glass fibre reinforced plastic (GRP) at experiment in 1974

With the words "Okay, it does not work, it was worth a try", we thanked them, and were already on our way out of the hall, when I suddenly discovered another machine in a corner. It looked slightly different, mainly because of an additional "tower-like" structure. "What kind of machine is this?" I heard myself asking. "A FANUC wire machine, it's kind of similar" was the answer, "alright, since you are here already and if you want to try another experiment".

"Let's go over there, but I have to tell you right away that it contains a profile for one of our customers". I only said "it doesn't matter". So the sample was mounted again - it immediately started to brew - and worked right away, in the truest sense of the word - the hot wire actually cut the promised profile out of the PCD - and formed it.

This visible success surpassed all our expectations. This "beastly material" had finally been conquered for the first time. And on top of that, this experiment had shown us how to produce profiling tools and mills under the influence of spark erosion. A discovery that would show its full value for the future only two weeks later... But first, I visited our patent lawyer the next day - the patent number 0010276 *"Herstellung beliebiger Profile in polykristallinem synthetischem Diamant mittels Funkenerosion"* was granted and published on April 21st, 1982, as one of the first European patents.

Horst Lach

further information: ***www.lach-diamant.de***

European patent no. 0010276
Method and device for electroerosive machining synthetic polycrystalline diamond and use of the diamonds machined according to this method.

Priority: October 13, 1978 - granted and published April 21, 1982

Patent claims:

1. Method for electroerosive machining synthetic polycrystalline diamond, characterized in that for producing arbitrary profiles the machining is made by means of spark erosion.
2. Polycrystalline synthetic diamond-produced according to claim 1, characterized in that the synthetic polycrystalline diamond machined by spark erosion shows the profile of a circular disc or a circle section or a circular ring or a circular ring section or a rectangle or an ellipsis section or of a form composed of these configurations.
3. Use of synthetic polycrystalline diamonds machined by spark erosion as cutting edges in single or multiple-cut rotary tools, preferably for machining of hardwood or synthetic resin sheets or plates of particle wood.

Cooperation, customer portals and artificial intelligence

Enables longest-possible use of tools

Step-by-step networking for in-house manufacturing, involving suppliers and customers and efficiently using data together - the digital services provided by c-Com, a member of MAPAL Group, make it all possible. However, the start-up isn't just developing its own applications. It's also generating added value for customers by working closely with cooperation partners.

Cooperation with MARPOSS: reduced setup times and maximum tool service life

The optimal and longest-possible use of tools represents a vital cost factor for machining companies. But compromises are often necessary - particularly in series production and as part of automated processes. Tools with a defined tool life are replaced as soon as the specified tool life has come to an end. In many cases, though, the tool has not truly reached the end of its tool life and replacement is not yet necessary. However, companies play it safe to avoid quality issues and the risk of producing items that later need to be rejected.

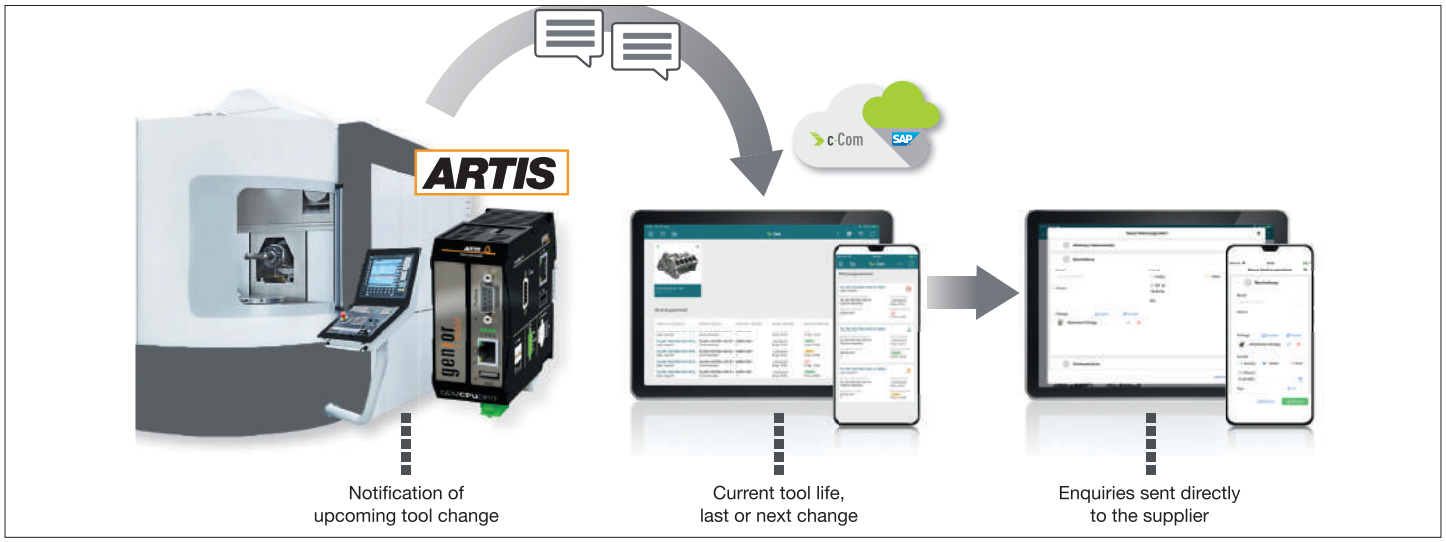
This is one of the elements addressed by the ARTIS GENIOR MODULAR module by MARPOSS. The fully automatic tool- and process-monitoring system has been an established feature of the market for many years. It works by recording various measurements and assessing them on the basis of several criteria. For example, the module can measure the force that needs to be generated during the machining process. This enables the system to identify tool wear and potential tool fractures. The current status is shown on the machine control operating display or via a connected computer. By taking the measurements into account, tools can be used up to the true end of their tool life. The entire system is protected by the measurements taken by the module.

MARPOSS recently launched a collaboration with *c-Com GmbH* and its c-Com open cloud platform to provide module users with additional value: the ARTIS GENIOR MODULAR module and c-Com are set to exchange data. Once the defined tool limits have been reached, the staff member responsible receives a notification on their mobile terminal - which is made possible by the cooperation with c-Com. As a result, operators can react more quickly and boost the efficiency of their manufacturing processes.

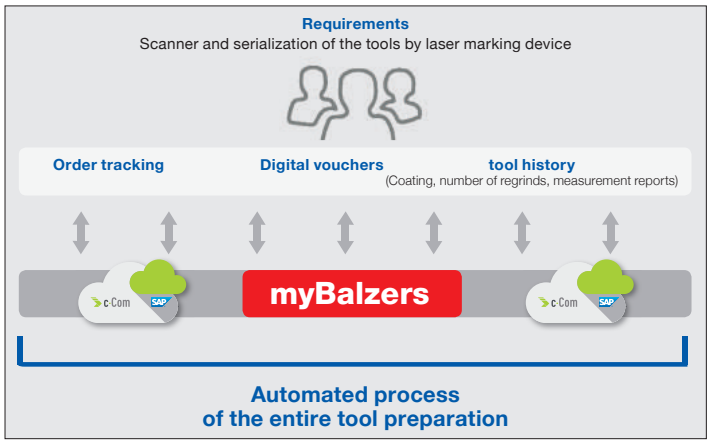
The exchange of data also helps to forecast for upcoming tool changes. Depending on the user's preference, c-Com creates an overview showing a time limit or the number of workpieces remaining. With this information, it becomes possible to stock up on new tools at production facilities in good time. This reduces setup time and machine downtime caused by unavailable or unprepared tools. The number of spare sister tools can be minimised and fewer tool mounts are required. At *EMO 2019,* MARPOSS and c-Com showcased the results of this promising collaboration - which is set to be intensified - for the very first time.

Cooperation with *Oerlikon Balzers:* transparency and sustainability thanks to digital processing for coating

Many tools are re-sharpened and re-coated to make production as cost-efficient as possible and to use raw materials sustainably. During this reconditioning process, the tool passes through several stages, which are usually carried



out by different companies. Tools are recorded several times to allow the processing of orders and to enable them to be assigned accordingly. This procedure is very complex for everyone involved - from the machine operators to the staff members carrying out the resharpening and coating. Physical product cards accompany the orders throughout the entire process chain. If a staff member responsible for resharpening sends a tool for coating, this staff member is often not aware of corresponding order status. This results in frequent queries. Neither tool users nor the coating and resharpening staff have an oversight of how many times the tool has been resharpened or coated in the past. In some cases, the number of resharpening processes is simply marked on the tool shank. Overall, the total benefit is reduced by the very high investment of time and effort required.

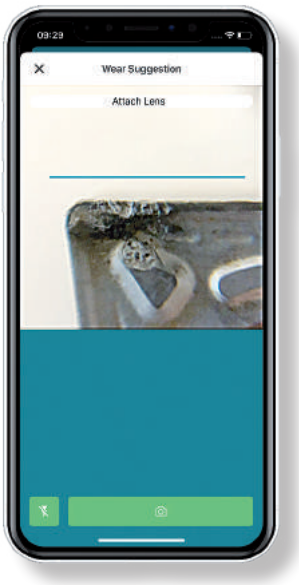


In cooperation with Oerlikon Balzers, c-Com has developed an application that enables significantly more effective and transparent order processing. The prototype was showcased at *EMO Hannover.* The only prerequisite to benefitting from the advantages of digital processing for coating is identifying all tools with a unique ID.

The c-Com application exchanges data with the *myBalzers* customer portal run by Oerlikon Balzers. This way, the entire order process is digitalised, and all receipts are available online. It is easy to share documents such as delivery slips, invoices or order confirmations, and the status of each coating order can be viewed in real time. There is no longer a need to ask for order updates - a quick glance at the application provides the user with all the information they need.

The speed of the overall order process is also increased as the recorded data is made available for all successive steps. Tools are returned from reconditioning after a shorter period of time. As a result of significantly reducing the manual data input, the process is no longer as susceptible to errors.

On top of that, machine operators have access to all important information about their tool any time. Thanks to the collaborative approach by c-Com they can access all data via the cloud. They know how many times their tool has been resharpened and are provided with comprehensive information on the coating. This data is extremely useful for the optimisation of processes. If the tool's performance drops, the cause of any issue can be quicker established and resolved.



The worn blade is documented using a smartphone; the app then identifies the type of wear

Involving coating staff significantly enhances the networking of the entire supply chain and serves transparency. This is one of c-Com's key objectives for the open cloud platform.

The c-Com wear detection app: a technical advisor in your pocket

Many factors need to work in concert to create a smooth, reliable machining process with optimal results. If the process results in poor output or even rejects, there may be multiple reasons for it. If worn blades are the cause, the following questions present themselves: what kind of wear are you dealing with? Why is this wear occurring and how can it be prevented in the future?

c-Com has developed a wear detection application to provide answers to these questions. The prototype for the application was presented at *EMO Hannover.* The application is very simple to use: first, the worn blade is documented using a smartphone and a conventional auxiliary lens for zooming in. The app then identifies the type of wear and suggests corresponding recommended actions. This allows users to prevent this type of wear in future.

The application is based on machine learning, a subcategory of artificial intelligence. This means that the application uses datasets to learn. Together with tool specialists at MAPAL, c-Com has compiled and categorized hundreds of images. Effectively, the algorithm was trained by being shown what different types of wear look like, allowing it to assess whether or not a blade is in good order.

As a result, the application can identify different types of wear, including clearance surface wear, crater wear or a built-up edge. Based on this, the app then provides appropriate suggestions - such as reducing the feed, increasing the spindle speed or using a different kind of coating. At present, the advice and suggestions for how to proceed are still static. However, the c-Com team is working hard on the beta version of the app to enable it to use the application data for each tool to provide specific individual suggestions on what action to take. Put simply, it's a technical advisor you can keep in your pocket - with numerous potential extensions aimed at making users' lives easier.

further information: ***www.mapal.com***

Daniel Lim new head for region APAC

Daniel Lim

Daniel Lim strengthens global management at LMT Tools and leads APAC region with immediate effect.

With Daniel Lim, LMT Tools gains an experienced executive leader with a strong track record of successfully developing large businesses for multinational companies. In his previous assignments, he has been overlooking Asia in different executive roles in relevant industries. As Head of APAC, he will take over responsibility for the Asian region from *Erwin Geissler,* who leaves the company.

LMT Tools is the technology leader for the development and production of precision tools and bundles its expertise in the three sales regions America, Asia-Pacific (APAC) and EMEA. This enables the company to adapt its global strategy to the needs of the individual markets.

further information: ***www.lmt-tools.com***

Surface solutions

Airbus qualifies *Oerlikon Balzers'* high-end coating system for REACH-compliant component coatings using BALINIT C

Oerlikon Balzers, a leading provider of surface solutions, has received qualification from Airbus for its RS 50 coating system, which uses the latest carbon coating technology. The RS 50 is located in Ferrières-en-Brie near Paris, a major Aerospace certified production facility of Oerlikon Balzers. The coating system has been selected and approved by Airbus to secure REACH-compliant PVD coatings with BALINIT C.

The RS 50 coating system is capable of producing BALINIT C coatings according to AIPS 02-04-007 Airbus specification. BALINIT C, a non-hazardous and REACH-compliant alternative to hard chrome plating, is a coating applied to aerospace components made of steel, titanium and various alloys that helps reduce surface fatigue, withstand wear, and high loads, whilst being lightweight and exhibiting low-friction.

Long-standing partnership with Airbus

In 2018, Oerlikon Balzers received the Qualified Supplier status from Airbus for its two customer centers in Great Britain and France for copper alloy substrate coatings using BALINIT C (WC/C:H tungsten carbide/carbon coating). Oerlikon Balzers has been successfully supplying surface coatings for Airbus since 2012.

further information: ***www.oerlikon.com***

TDM Systems

Guido Reisch joins as Head of Global Services

Guido Reisch took over as head of the service department at TDM Systems. Reisch has a master's degree in computer science and has been working in the industry for almost 30 years, so he knows exactly what customers' IT want. Over the last 15 years, the native Westphalian has worked in various roles, even on an international level, for a US IT group that operates internationally. Together with his team at TDM Systems, he is currently restructuring the service offerings for TDM customers.

TDM Flex Care Credits - service and advice as required

The TDM Flex Care Credits are being introduced: TDM customers order a certain number of points which they can use flexibly for questions concerning their TDM solution. Classic services can be retrieved as well as customer-specific advice and assistance. This way, they only pay for what they actually need. Inquiries are made quickly and directly via the TDM customer portal in the Competence Center.

further information:
www.tdmsystems.com

Guido Reisch

"Ideas are still sparkling"

The Hanau entrepreneur *Horst Lach* celebrated his 80th birthday, April 3, 2020

Horst Lach

In his 80-years-long life Horst Lach has shown great skill in guiding the company founded by his father in 1922 and taken over by him in the 1960s through times, which have not always been simple. The company developed from a sought-after diamond cutting business in the 1920s into a successful tool manufacturer: *LACH DIAMANT* manufactures globally high-precision diamond and CBN tools and works out suitable tool concepts together with its customers in the automobile, aerospace, wind power, electronic and furniture industries as well as in the mechanical engineering. By now the company has more than 150 employees at the facilities in *Hanau,* Lichtenau near Chemnitz and *Grand Rapids*/Michigan, USA.

Horst Lach proves his skill and intuition for the next necessary step. In now 60 years of service he had a lasting influence on the tool industry with ideas "stepping out of line" and indispensable discoveries. Starting with the development of the first CBN grinding wheels for tool grinding of high-alloy steels, through the use of spark erosion for the economic machining of super-hard PCD, to the presentation of a complete diamond tool and saw program for the wood industry as the first company worldwide. Horst Lach's brilliant idea to use "electric spark" as a medium for targeted shaping of super-hard PCD is considered as groundbreaking discovery enabling from that moment the efficient and economical machining of PCD circular blanks. The long list of successful patents and implemented tool solutions gave Horst Lach the name *"pioneer of the diamond and CBN tool industry"*. As an author Horst Lach regularly reports in "hp tooling" about his life full of pioneering discoveries and achievements.

further information: ***www.lach-diamant.de***

Sandvik Coromant joins forces with Microsoft

Sandvik Coromant has embarked on a unique venture with Microsoft to drive forward the development and digitalization of the manufacturing industry. Combining Sandvik Coromant's expertise in machining with technical solutions from Microsoft, the collaboration will seek to link up parts of the production chain to create solutions for the next generation of manufacturing. The contract also includes an acceleration of the internal digitalization network for Sandvik Coromant.

Sandvik Coromant's *CoroPlus®* offering, developed in part with Microsoft, is based on Azure IoT Suite, Cortana Intelligence Suite and Dynamics 365 for Field Service. Among other things, the offering connects people, machines, tools and data on a single platform to offer Sandvik Coromant's customers a better basis for decision making, and provides an overview of the various developments in the manufacturing process. This can enable savings, for example, by reducing machine downtimes.

The new joint venture between Sandvik Coromant and Microsoft gets under way in the first quarter of 2020 and will involve operations both in Sweden and abroad.

further information: ***www.sandvik.coromant.com***

International Federation of Robotics

Milton Guerry as new President

The Executive Board of the International Federation of Robotics (IFR) elected *Milton Guerry* of SCHUNK USA as new President. *Klaus Koenig* of KUKA Robotics has been appointed as IFR's new Vice President.

Milton Guerry heads the SCHUNK USA team as its President based in Morrisville, North Carolina. He joined SCHUNK in 2000 and has held various leadership roles, assuming his current role as President in 2007. Milton is a member of the *Robotic Industries Association's* (RIA) Board of Directors. He began his career in the automotive industry in a number of engineering and technical functions.

Armin Schlenk, Chairman IFR Marcom Group; Milton Guerry, IFR President; Susanne Bieller, IFR General Secretary (left to right)

further information: ***www.ifr.org***

Laser technology:

Opportunities for cutting tool manufacturers

written by: **Philipp Esch, Thomas Götz** and **Andreas Gebhardt,**
authors from the *Fraunhofer Institute for Manufacturing Engineering and Automation IPA*

The manufacturing industry makes a significant contribution to the overall economic value added and is the key to the international competitiveness of industrialized countries. Of particular importance for the manufacturing industry are machining production processes that are characterized by precision, geometric variety and a high degree of automation. Reliable and efficient cutting tools can therefore be found in almost every manufacturing company.

However, the sector of cutting tool manufacturers which is dominated by small and medium-sized enterprises *(SMEs)* is currently facing a multitude of challenges. On the customer side, the requirements regarding quality, productivity and tool performance are increasing. In addition, the industry is facing a profound change in response to digitalization as well as fundamental upheavals in the automotive industry due to the increasing hybridization and electrification of powertrains. A further challenge on the market side is the growing competition due to low-cost cutting tools from low-wage countries.

Hence, innovation and a reduction of manufacturing costs, access to new technologies and manufacturing processes are required to maintain the technological leadership of cutting tool manufacturers, especially SMEs on the world market in the medium and long term.

Conventional production chain of cutting tool manufacture

The materials, procedures and process steps used in the cutting tool manufacturing process influence the quality of the cutting tools and their performance in machining[1]. In the following, the individual process steps in the production of cutting tools are illustrated by way of example, as shown in *figure 1*. Depending on the cutting tool design, individual process steps can be omitted or their sequence can be reversed.

In a first process step, the blank is typically manufactured from powder metallurgical materials in a pressing and sintering process at high temperatures. To produce its final contour, the blank must then pass through various process steps for post-processing and finishing. Usually, the tool geometry is created by machining processes with a geometrically undefined cutting edge, such as grinding using ultra-hard abrasives like diamond or boron carbides. In addition, ablative processes such as electrical discharge machining are used especially for ultra-hard materials.

For the later use of a cutting tool, its cutting edge quality is of decisive importance. In order to achieve low process forces and high surface qualities, sharp cutting edges are increasingly required, which are mechanically rounded to increase tool life. Various edge preparation techniques such as grinding, blasting or brushing are available to

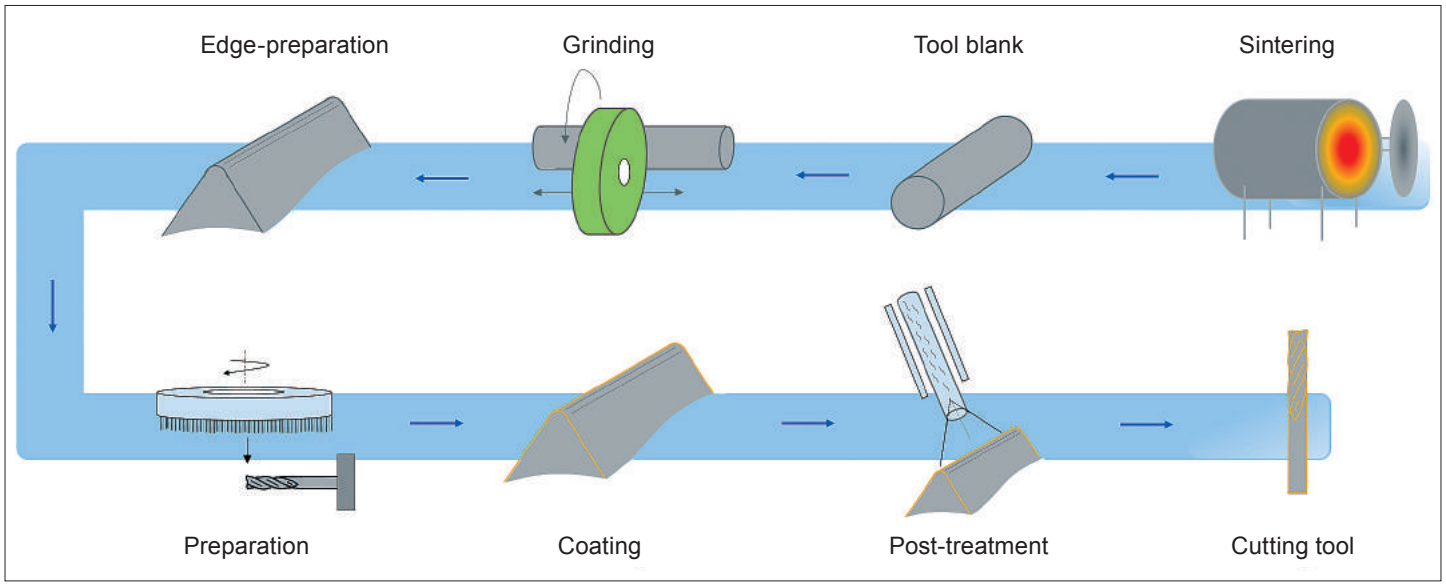


figure 1
Steps of the cutting tool manufacturing [Fraunhofer IPA]

produce a defined and reproducible cutting edge geometry and high cutting edge qualities without damaging the cutting material[1].

In the case of a subsequent coating, surface and edge zone preparation of the substrate material are carried out by means of mechanical process steps such as microblasting or brushing to achieve good coating adhesion properties[1]. The coating usually consists of a composite of a tough substrate and a hard material layer, which is applied by means of chemical (Chemical Vapour Deposition, *CVD*) or physical (Physical Vapour Deposition, *PVD*) coating processes[2]. The coating systems serve as protection against wear, oxidation, corrosion and heat and lead to an increase in productivity and tool life[1].

Laser technology as a complementary procedure to conventional grinding

Cutting materials and their wear mechanisms affect both production and tool lifetime and hence the overall production costs. Therefore, wear-resistant, hard and tough cutting materials, preferably hard metals based on tungsten carbide, cermets based on titanium carbide or titanium nitride as well as diamond based cutting materials are increasingly used for the production of cutting tools to meet the requirements for cutting new high-performance materials[2].

While the machining of tool steels like cold and high-speed steel (HSS) proves to be unproblematic, the processing of extremely hard cutting materials is considerably more complex. For sintered carbides, cutting processes with geometrically undefined cutting edges are essentially used, such as grinding with diamond- and CBN grinding wheels[2]. On the other hand, ultra-hard high-performance cutting materials such as PCD, MCD and CBN are very difficult to grind due to their hardness and are subjected to high wheel wear. Hence, such cutting materials are generally machined using ablative techniques such as electro chemical machining and are subsequently finish-ground, if necessary. This makes the process very time-consuming and cost-intensive[3].

In addition to conventional grinding, laser technology is increasingly applied as a technical and economical complement for the production of cutting tools. The laser machining, as depicted in *figure 2,* allows cutting materials such as iron-based tool steel but also carbides and diamond-based ultra-hard cutting materials to be processed gently and almost athermal providing the highest quality in a short time. The laser beam generates tool cutting edges and geometries by vaporization of the material[4, 5]. This minimizes material heating in the processing area, even with materials that conduct heat well, such as carbide, and reduces the risk of damaging the edges of the substrate[6]. Cutting ceramics, which are brittle due to their hardness and therefore difficult to process, are also suitable for machining by laser technology. Here, short-pulse laser technology is used, which enables selective sublimation of the material without micro-crack formation and damage[7]. The laser also enables chip grooves or chip breakers to be inserted into the cutting tool and thus increase the tool life. The implementation of such fine three-dimensional structures and the high-precision positioning on the cutting tool itself cannot be achieved mechanically, e.g. by milling or grinding[8].

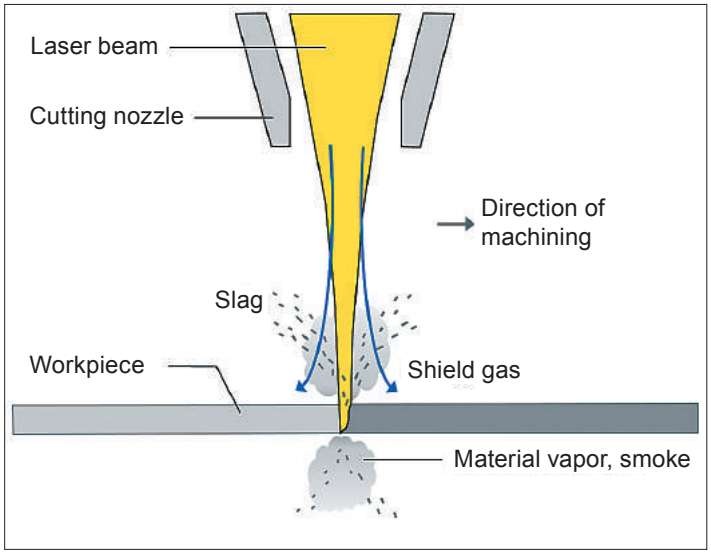


figure 2
Schematic of laser machining [Trumpf]

Cutting edge preparation

Tool life and working behaviour are decisively determined by the micro geometry of the cutting edge. The impact of thermal and mechanical loads during cutting processes induce wear. Typical wear mechanisms in the cutting of metals are abrasive, adhesive, diffusive and tribochemical wear. The cutting of fibre-reinforced plastics is mainly dominated by abrasion. Especially in terms of abrasion the resulting form of wear is cutting edge rounding, flank or crater wear. Due to high mechanical load outbreaks or bursts are also likely.

As a result of the production process by grinding technologies, the cutting edge topography is characterized by microscopic chipping. Although the cutting edge is macroscopically sharp, the microscale geometry is reigned by undefined roughness. This roughness induces force peaks and stress localization in the tooling material which can result in premature failure[6, 9]. The accumulation of this failure namely the successive erosion of hard particles in case of cemented carbides leads to strong and uncontrollable tool wear, often resulting in abrupt total failure of the entire cutting wedge[10].

Also, against earlier assumptions a cutting edge of infinite sharpness without a measurable edge radius is not suitable for most applications, especially for cutting metals, due to high mechanical load and cutting forces. The unstable edges are feasible for bursts and account for high initial wear[11, 12].

In order to control both wear behavior and edge stability, edge preparation techniques are applied. Common methods

for cutting edge rounding or chamfering include dry and wet abrasive waterjet, brushing, drag finishing, magneto abrasive machining and laser machining[13, 14], as shown in *figure 3*.

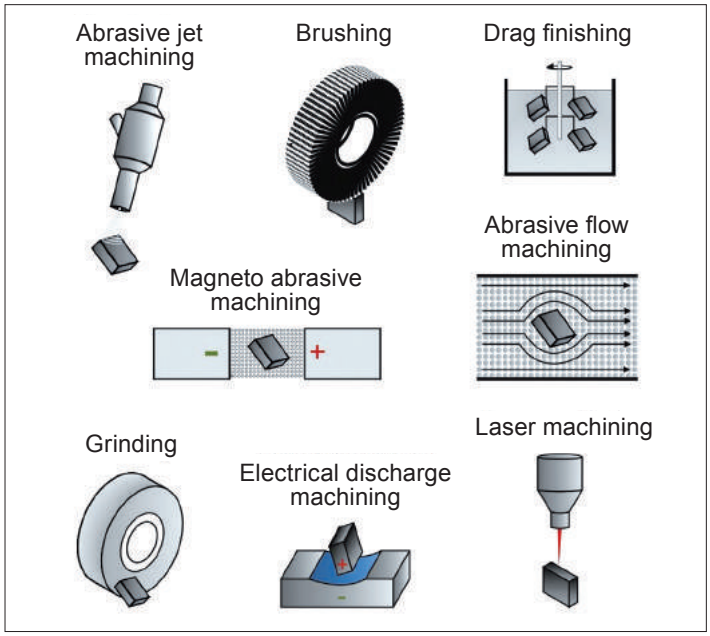


figure 3
Methods for cutting edge preparation[13]

With laser technology, advantages concerning precision and reproducibility can be combined. Ultra-short pulsed (USP) lasers allow a virtually athermal processing with almost no thermal conductivity. On the other hand, the thermal impact can be used to alloy or disperse the fringe of HSS-tools by short-term melting. In terms of edge preparation, laser process can be used to constitute a purpose specific edge geometry in a multitude of cutting materials[15]. The non-contact nature of laser material interaction also means advantageous wear free processing and hence high reproducibility in industrial series production. To this day, conventional cutting preparation techniques still prevail. With the continuing understanding of laser-material interaction and better process guidance, the application of laser in respect of edge preparation may soon offer a viable technological alternative.

Surface functionalization by means of microstructures

In terms of tool wear mechanisms, adhesion is quite prominent in machining ductile materials like some low-carbon mild steels, aluminum and titanium alloys. Material adhesion is generally associated with built-up edges and built-up layers, which interfere with the cutting process in a way that the effective cutting edge geometry is changed and hence the surface integrity of the workpiece deteriorates.

Measures to alleviate adhesion comprise low friction coating systems, use of lubrication and the functionalization of tool faces by means of micro structures. The first two aspects are already state of the art, the latter aspect of micro structured tools is still under research.

USP laser systems achieve the implementation of defined nano- and microscale structures on the tool surface with very high precision and least thermal impact. In academia micro structured tool faces are investigated in a variety of processes. Research activities indicate promising potential in reducing process forces and adhesion combined with benefits of longer tool life and better quality performance[16, 17, 18]. Lower cutting forces and less adhesion are confirmedly explained by better tribological characteristics and less friction[19].

The microstructures in question are in most cases defined technical geometries like dots or line-like pitches as given exemplary in *figure 4*. The surface preparation contributes to less contact between chip and tool, higher shear angles and higher lubrication effectiveness[16, 20]. The cavities function as a reservoir and supply lubrication under concealed conditions when the cutting tool is engaged[17, 21].

Some researchers also consider bio-inspired surface designs in order to achieve higher anti-adhesion features and better lubrication distribution. The transformation from prototype status and laboratory conditions onto production tool has yet to be implemented in any case. Still, legitimate questions on real tool performance behavior and tool life have to be addressed.

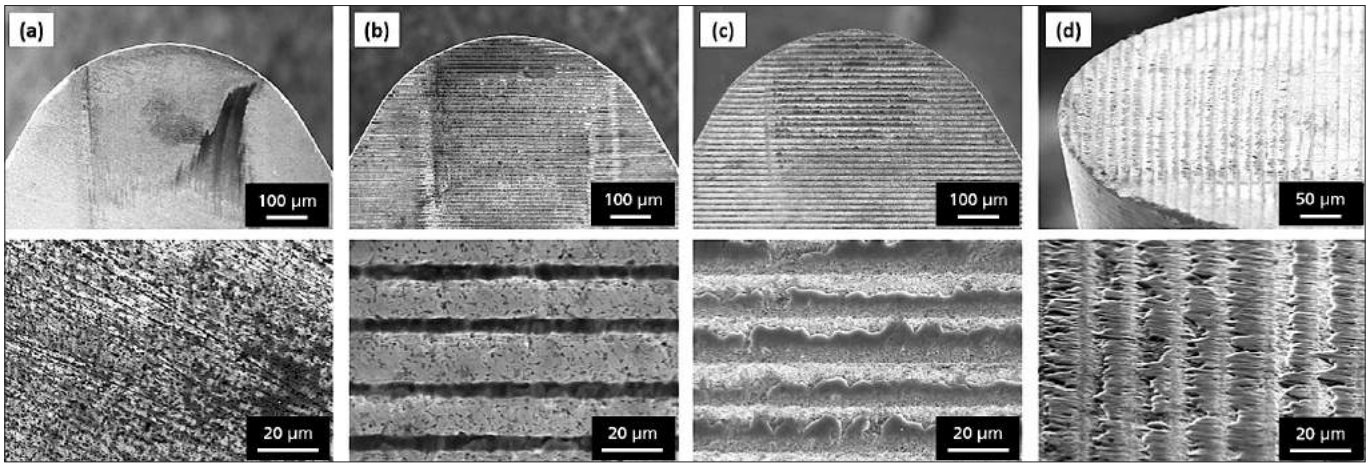


figure 4: Miroscopic images of tools with different rake face structuring[19]

Conclusion

The performance requirements in modern machining processes demand for new cutting materials but also affect the production process. The progressive understanding of tool-material interaction, wear mechanisms and working material behavior create new approaches in tool optimization. The cutting tool micro geometry, pre- and post-treatment steps but also new high-strength cutting materials come in focus, raising the questions of how to process and realize the features.

Laser technology has greatly evolved in recent years and new applications arose in many technical fields. With respect to cutting tool manufacturing, laser application delivers the access to further possibilities. With new USP laser systems high efficiency on the one hand and high precision processing on the other can be achieved. As this article stated, the application of laser is suitable in macro working of cutting tools as an alternative or logical addition to grinding but also in the field of micro working to precisely define cutting edge conditions or micro structured surfaces.

Literature

[1] *Friemuth, T. (2002):*
Herstellung spanender Werkzeuge. Postdoctoral thesis.
in: Fortschrittberichte VDI: Reihe 2, Betriebstechnik 615 (2002)

[2] *Klocke, F.; König, W. (2007):*
Fertigungsverfahren 1. Drehen, Fräsen, Bohren
8., neu überarbeitete Auflage

[3] *Denkena, B.; Köhler, J.; Rehe, M. (2010):*
Einsatz hochharter Schneidstoffe beim Schleifen
in: Wissenschaft und Forschung 3 (2010), page 26-32.
accessible: https://d-nb.info/1006343032/34

[4] *Körber Schleifring GmbH (2011):*
Effektiv lasern und schleifen
accessible: https:///

[5] *Ewag AG (2017):*
Werkzeugbearbeitung via Laser: Ultrakurzpuls-Technologie meistert schwierigste Aufgaben beim Werkzeugschleifen
accessible: https://mav.industrie.de/fertigung/maschinen/werkzeugbearbeitung-via-laser/

[6] *Kötter, D. (2006):*
Herstellung von Schneidkantenverrundungen und deren Einfluss auf das Einsatzverhalten von Zerspanwerkzeugen, Doctoral thesis

[7] *Pulsar Photonics GmbH (n.d.):*
Bearbeitung von Technischer Keramik mittels Ultrakurzpuls Laserstrahlung
accessible: https://www.pulsar-photonics.de/bearbeitung-von-technischer-keramik/

[8] *Marcatis Laserbearbeitung (2019):*
Mikrolasergravur von Spanleitstufen und Spanbrechern bei MARCATIS
accessible: https://www.marcatis.de/mikrolasergravur-von-spanleitstufen-und-spanbrechern-bei-marcatis/

[9] *Biermann, D. (2012):*
Spanende Fertigung: Prozesse, Innovationen, Werkstoffe
6. Ausgabe, Essen: Vulkan-Verlag

[10] *Tikal, F.; Bienemann, R. (Hrsg.) (2009):*
Schneidkantenpräparation: Ziele, Verfahren und Messmethoden; Berichte aus Industrie und Forschung
Kassel: Kassel Univ. Press

[11] *Denkena, B.; Köhler, J.; Mengesha, M. S. (2012):*
Influence of the cutting edge rounding on the chip formation process: Part 1. Investigation of material flow, process forces, and cutting temperature
In: Production Engineering 6 (4-5), page 329-338

[12] *Denkena, B.; Boehnke, D.; Leon-Garcia, L. (2005):*
Einfluss der Schneidkantengeometrie auf die Zerspankräfte und auf das Verschleißverhalten
in: ZWF 100 (9), page 490-494

[13] *Denkena, B.; Biermann, D. (2014):*
Cutting edge geometries
in: CIRP Annals - Manufacturing Technology 63 (2), page 631-653

[14] *Heisel, U. (2014):*
Handbuch Spanen
2., vollst. neu bearb. Aufl., München: Hanser.

[15] *Haferkamp, H; Bunte, J; Becker, H; Deutschmann, M. (2004):*
Lokale lasergestützte Verschleißreduzierung bei spanenden Schaftwerkzeugen in Verbindung mit Multilayer-Dünnschichten
Forschungsbericht P 521

[16] *Zhang, K.; Deng, J.; Sun, J.; Jiang, C.; Liu, Y.; Chen, S. (2015):*
Effect of micro/nano-scale textures on anti-adhesive wear properties of WC/Co-based TiAlN coated tools in AISI 316 austenitic stainless steel cutting
in: Applied Surface Science 355, page 602-614

[17] *Arulkirubakaran, D.; Senthilkumar, V.; Kumawat, V. (2016):*
Effect of micro-textured tools on machining of Ti-6Al-4V alloy: An experimental and numerical approach
in: International Journal of Refractory Metals and Hard Materials 54, page 165-177

[18] *Enomoto, T; Sugihara, T. (2010):*
Improving anti-adhesive properties of cutting tool surfaces by nano-/micro-textures
in: CIRP Annals - Manufacturing Technology 59 (1), page 597-600

[19] *Kawasegi, N.; Sugimori, H.; Morimoto, H.; Morita, N.; Hori, I. (2009):*
Development of cutting tools with microscale and nanoscale textures to improve frictional behavior
in: Precision Engineering 33 (3), page 248-254

[20] *Enomoto, T; Sugihara, T. (2011):*
Improvement of anti-adhesive properties of cutting tool by nano-/micro-textures and its mechanism
in: Procedia Engineering 19, page 100-105

[21] *Sharma, V.; Pandey, P. M. (2016):*
Recent advances in turning with textured cutting tools: A review
in: Journal of Cleaner Production 137, page 701-715

Italian excellence in lasered PCD tools

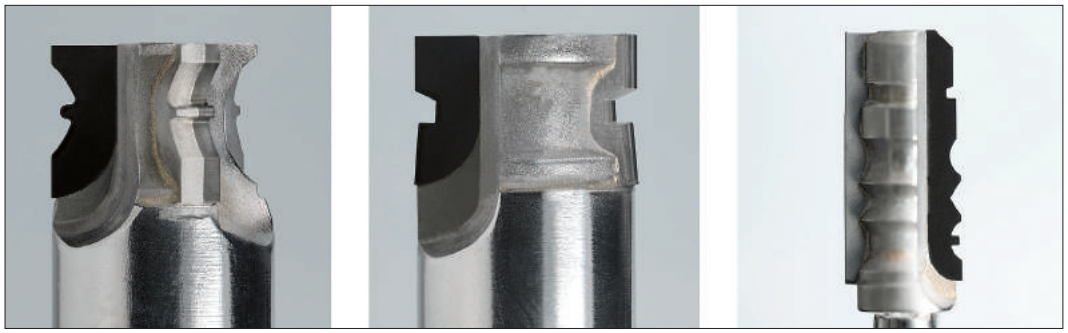
For eyewear, dental, aerospace and automotive industry

The company *MICTU srl* is located in Quero Vas, a town in northern Italy. Founded in 1986 by Antonello Collavo, MICTU counts today 14 employees. Their main focus is the eyewear, dental, aerospace and automotive industry. The extensive knowledge in the manufacturing of tools using various manufacturing technologies got extended by laser technology, when a LASER LINE PRECISION machine from EWAG was installed.

Tool production

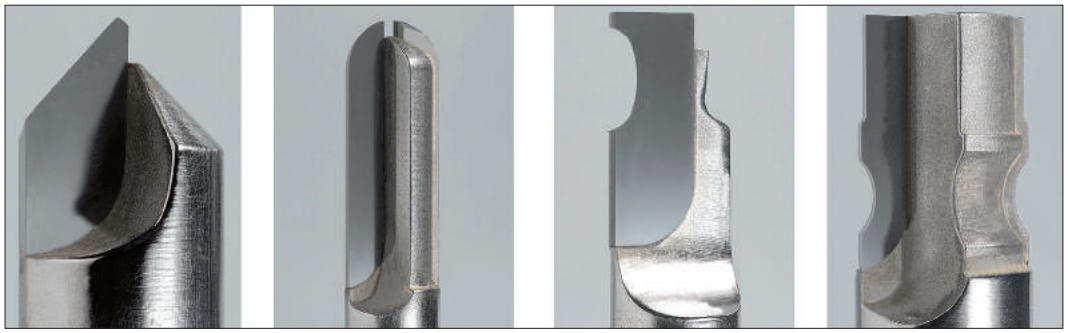
Especially for ultrahard materials, such as polycrystalline diamond (PCD) or chemical vapor deposited diamond (CVD-D) materials laser technology complements the tool range by flexibility in tool design, programming and fast lead times from design to production. Compared to other technologies e.g. grinding the low need of consumables such as grinding wheels, coolant, etc. gives the company a striking advantage.

MICTU's tool range manufactured using laser technology consists mainly of form tools in a diameter range of 3 to 60 mm. Also special focus is placed on complex geometries (e.g. concave profiles) for eyewear industry, as depicted in the following images.



Laser processed PCD tools for eyewear industry in a Ø range of d = 4 - 8 mm for cutting lenses

Brazed profile tools used for eyewear industry in a Ø range of d = 6 - 30 mm



Laser processed PCD tools for eyewear industry in a Ø range of d = 6 - 8 mm

Laser technology enables the operator to cut, shape and even bring diamond to the desired form just by sending out a fine focused ray of light. In grinding wheels and coolant; in erosion wire and dielectric liquid needs to be provided to the machine. This enables MICTU to operate the machine multiple weeks by simply adding a new blank after a customer tool is finished. In addition, very short setup times can be realized, programming can be executed on a separate computer and the necessary files can be quickly transferred to the machine, minimizing the downtime between jobs. Therefore, small batch sizes are easily realized using laser technology.

«It's a big advantage to have an open software, which allows multiple tests and the freedom of shapes and forms.»

Andrea Collavo, Product Development Engineer

The machining operator manages to program a tool in approximately 10 to 20 minutes and produces the tool in another 10 to 20 minutes. This is realized by designing the tools in a perfect way for laser production and eliminating any unnecessary processing steps. Production times can be cut in half, while enhancing cutting edge quality, e.g. in roughness by a factor of three leading to better products for MICTU's customers leading to a strong competitive advantage on the market. Tool design was adapted for optimal laser beam accessibility with respect to the tool body, in order to access the cutting edge in an ideal way. In terms of PCD grit size, MICTU is currently developing strategies to produce tools using larger diamond grains for higher tool lifetime. EWAG's software LaserSoft integrated tool for automatic 3D model generation based on a simple DXF curve of the tool without modelling axial or radial angles is great, but usually MICTU's operators prefer to work directly in 3D in order to give the tool the desired shape.

«The production speed is more than twice as fast as it is with common CNC machines. And not only the speed is much better, but also the roughness quality got improved.»

Andrea Collavo, Product Development Engineer

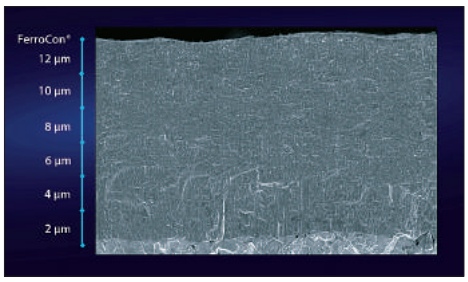
Think LASER!

The benefits of laser technology in tool manufacturing are demonstrated by MICTU's excellence and knowledge in tool design and quick adaptability for novel tool manufacturing processes. Still new features, shapes and geometries are to be tested and long-time analysis of customer's feedback is still to be awaited but the quality, ease of programming and fast lead times from design to manufacturing render the LASER LINE PRECISION by EWAG ideal for today's and the future market in cutting tools.

further information: ***www.grinding.ch//www.mictu.com***

Game changer

HiPIMS coating material



The HiPIMS technology from CemeCon enables coating thicknesses from 1 - 12 µm

In order to achieve a high metal removal rate in heavy machining of cast iron and steel, powerful cutting inserts are required. Every µm counts when it comes to tool coating to increase performance and tool life. FerroCon®Quadro, the HiPIMS coating material with 12 µm coating thickness from CemeCon, ensures impressive cutting results.

When it comes to really thick coatings, manufacturers of cutting inserts have had no choice but to use the CVD coating process. However, this is very limited in its possibilities. With HiPIMS technology the situation changes completely. Unlike CVD processes, HiPIMS doesn't require any toxic or environmentally hazardous chemicals, while delivering layer thicknesses from 1 - 12 µm. Until now, PVD technology was used for thin layers and CVD for layers from 6 µm.

This is possible because the HiPIMS technology combines advantages that no other system provides: smooth, tough layers with low residual stress - and this with every conceivable material. Almost any element of the periodic table can be incorporated into the layers. With coating temperatures around 500°, HiPIMS is additionally very gentle on the substrate, which prevents carbide embrittlement.

FerroCon®Quadro changes the rules

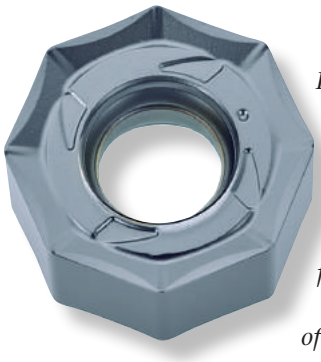
When CemeCon developed the first HiPIMS coatings to market maturity, it was particularly manufacturers of microtools who very quickly took advantage of the unique selling points achieved by the technology. Other tool types quickly followed, because HiPIMS combines the advantages of all PVD coating technologies. With FerroCon®Quadro, a coating material is now also available for cutting inserts intended for rough machining. This opens up completely new possibilities in the machining of cast iron and steel.

Inka Harrand, Product Manager Cutting Inserts at CemeCon, is pleased about the very positive response of the insert manufacturers to the new HiPIMS coating material FerroCon®Quadro: "All initial orders are closely monitored by us. We carry out an extensive incoming inspection, which includes, among other things, the remeasurement and documentation of the edge rounding. An edge rounding of about 40 µm before coating creates ideal conditions for optimum adhesion. We have surprised some users that, thanks to our technology, such thick coatings adhere well! HiPIMS significantly reduces the residual stresses in the coating. Therefore 12 µm are possible without any problems. This is a paradigm shift in roughing and heavy machining! Each µm of coating thickness provides more performance and significantly increases the tool life of the cutting inserts".

And the superiority of FerroCon®Quadro is not just theory, but has been confirmed in numerous applications: when milling unalloyed tempered steel C45 (1.0503) with a hardness of 32 HRC (vc = 220 m/min, ap = 0.5 m/min, without cooling), for example, cutting inserts with FerroCon®Quadro achieved a tool life of 180 min. Comparable cutting inserts with other coatings had tool lives of 120 min, 95 min and 62 min, respectively, which were significantly lower.

Build the lead with HiPIMS

Dr.-Ing. Christoph Schiffers, Product Manager Technology, is convinced: "HiPIMS is a gamechanger. Currently there is no system on the market that is more flexible, faster and more future-proof than our CC800® HiPIMS coating system. Coupled with the right know-how and our premium coating materials, this means that our customers are not only in pole position, but can stand on the podium at every race".



FerroCon®Quadro opens up completely new possibilities for cutting inserts in the machining of cast iron and steel

With a coating thickness of 12 µm, FerroCon®Quadro ensures greater performance and significantly increases the service life of the cutting inserts

further information: **www.cemecon.de**

Sharpening tools using laser light

Laser-based sharpening machine

The Swabian sharpening specialist VOLLMER has completed its range of products with a laser-based sharpening machine. VOLLMER drawn on its 111 years of experience in all fields to develop the *VLaser 270*. Innovative kinematics ensure fast and high-precision machining of ultra-hard cutting materials, always keeping the tool in the center of the focal point based on the C-axis. The relevant automatic settings enable unmanned use of the VLaser 270 around the clock.

Vollmer presents its VLaser 270 laser machine for the first time

Thanks to the non-contact procedure, the energy from the laser allows the new VOLLMER VLaser 270 machine to sharpen the cutting edges of cutting tools which are tipped with PCD (polycrystalline diamond) or other ultra-hard materials. The laser machine completes VOLLMER's range of grinding and erosion machines, making the Swabian machine manufacturer a full-liner of sharpening technologies, whether rotary tools, circular saws or metal-cutting band saws. This means that VOLLMER, as a full-liner, irrespective of which process is used, is always able to provide its customers with the optimum sharpening solution for their individual requirements.

VLaser 270 is based on innovative VOLLMER kinematics

At the core of the VLaser 270 is its fixed laser beam guidance with innovative machine kinematics. The way in which the five-axes are arranged on top of each other means that the tool is always machined at the pivot point of the C-axis. This makes it possible to machine tools with minimal axis movement and to ensure stable process control. At the same time, the kinematic chain enables high path accuracy, which has a positive impact on the machining accuracy and quality of the tools.

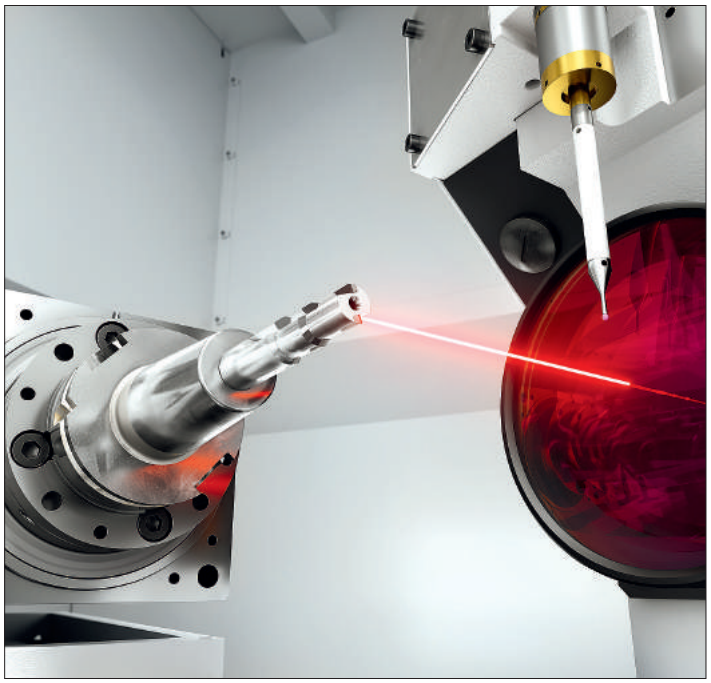
The VLaser 270 can optionally be equipped with a counter point to achieve even higher concentricity. This makes the VLaser 270 the first laser machine on the market to have such a counter point. The result is a machine that is compact in size, with dimensions that are clearly defined. The VLaser 270 can be combined with the HC 4 tool change automation, which is also used for other VOLLMER machines.

The VLaser 270 is very flexible, highly efficient and ensures perfect cutting edge quality. It works without making contact, without tool wear and without any significant thermal influence. This latest innovation from VOLLMER allows the customer to increase the operating life of tools and contribute to the sustainable optimisation of manufacturing processes. It is equally suitable for manufacturing and resharpening ultra-hard cutting materials.

Lasers' considerable potential

VOLLMER's laser technology can be used to optimise different processes in tool manufacturing, including the machining of chip guide notches. This involves incorporating notches behind the tool cutting edge in order to influence the cutting properties. VOLLMER also wants to use its laser machine to carry out applications such as chamfer machining and preparing cutting edges.

"We're incorporating lasers into our range of machinery in such a way that they provide tool manufacturers with clear added value for sharpening," remarks *Dr Stefan Brand,* CEO of the VOLLMER Group.



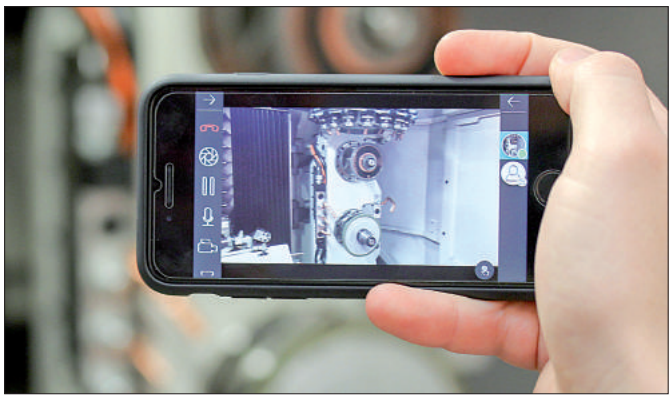
The VOLLMER VLaser 270 machine's laser light and innovative kinematics ensure the fast and high-precision machining of tools with ultra-hard cutting materials

further information: **www.vollmer-group.com**

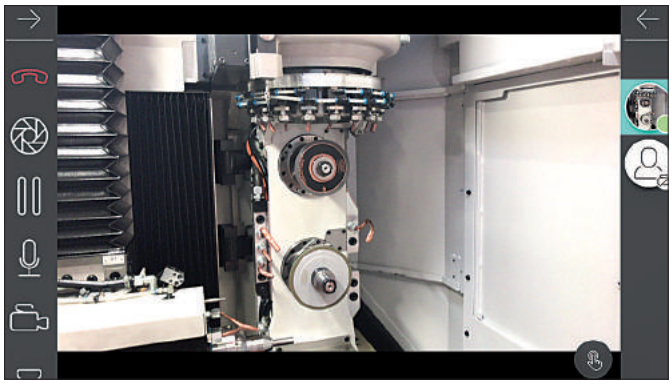
VOLLMER launches *Visual Support*

With the new *Visual Support,* a remote desktop connection or web-based full HD video and audio communication can be established. By using these apps, the VOLLMER help desk has another channel for direct communication with our customers and is therefore expanding its existing options, such as e-mail, phone or personal on-site support.

Visual Support is part of the *V@dison initiative,* in which VOLLMER is combining its digital solutions for Industry 4.0 and the IoT *(Internet of Things).* The newly launched live transmission is based on the oculavis SHARE service solution and can be used on mobile devices such as smartphones, tablets or smart glasses. Thanks to live streaming, the VOLLMER expert can be right where they need to be on site and can provide the customer with targeted instructions. Integrated functions such as screen sharing or white board make communication precise and straightforward. The process can be tracked transparently for both parties and multiple participants can be involved if necessary. Since all participants can see the same thing via Visual Support, misunderstandings in communication are reduced, faults are identified quickly and questions are answered more effectively. Ideally, on-site deployments can be reduced. The apps also offer the option for tailored online training sessions, turning customers themselves into experts.



The "oculavis SHARE" app



Thanks to this screen sharing, all participants share the same view of the interior workings of a sharpening machine

further information: ***www.vollmer-group.com***

First 3D metal printer made by CHIRON

For manufacturing larger, more complex components

The CHIRON Group, specialist in the field of CNC-controlled vertical milling and turning machining centers, has developed the AM Cube, its first 3D printer for manufacturing larger, more complex components. It is suitable for coating and repairing components, as well as printing near net shape parts. With this new printer, the *Tuttlingen*-based CNC specialists are expending their core competencies to include additive manufacturing, alongside their existing focuses on metal machining and automation. In so doing, CHIRON aims to offer attractive complete solutions from a single source, incorporating this new, dynamic and growing market area.

Additive manufacturing start-up

"The *Additive Manufacturing* department is a start-up within our own business group," explains *Axel Boi,* Head of Additive Manufacturing at the CHIRON Group. "With this 3D metal printer, made by CHIRON, we are creating a facility for manufacturing larger components with long procurement times and high material prices. This technology can be used effectively in the mechanical engineering, tool manufacturing, energy production and aerospace sectors. These are all important target sectors for the CHIRON Group", the expert adds.

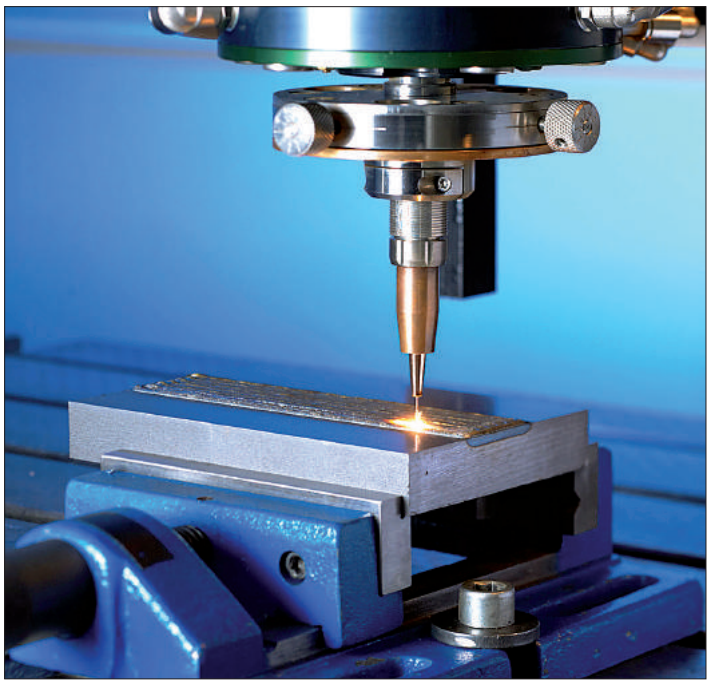
Intuitive operation and programming

The new AM Cube is based on a conventional cartesian coordinate system, just like a CNC machining center. Operation and programming of the AM Cube is intuitive. The system is programmed either using a standardized DIN ISO code or, for complex components, using a CAD/CAM software tool. All aspects of the system can be controlled using tried-and-tested Siemens components, from hardware to the HMI through to programming of the AM Cube.

Unlike other 3D metal printers, the print head of the CHIRON AM Cube can be changed during an active printing/coating process. This option enables the AM Cube to be used to combine different process requirements: for instance, one print head could be used to achieve a high surface quality, and another could be used to achieve a high deposition rate. The automatic head change function enables these properties to be combined in a single workpiece. This is another area where the professionals at CHIRON have put their comprehensive process expertise and many years of experience in using machining centers into practice. Due to the low quantities manufactured using this process, high flexibility is a crucial factor across all industries. The AM Cube is equipped with a total of three print heads. With the AM Cube, wire and powder as deposition material can be applied within a single manufacturing process in different production phases.

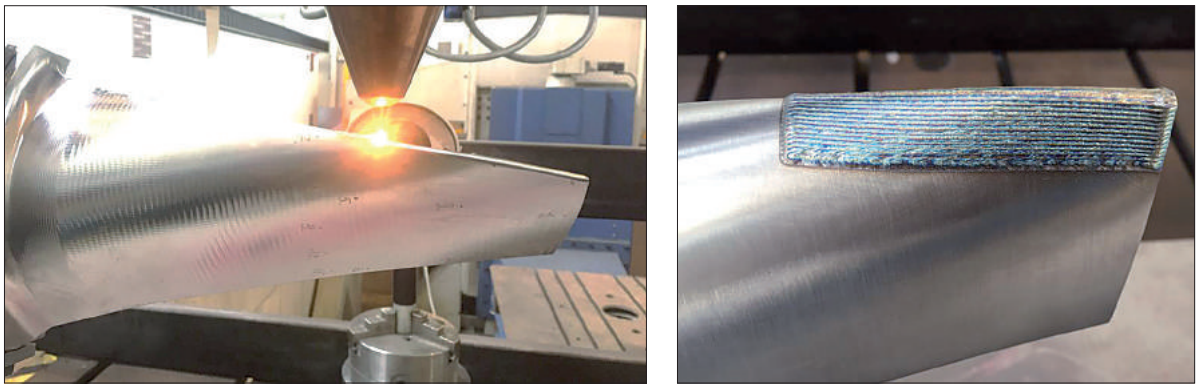
Deposition welding with different raw materials

By designing a printer for the two commonly used deposition materials - wire and powder - the machining center manufacturer has also patented a completely new technology. Both processes have their applications: while coating with powder is the most commonly used process, wire-based laser metal deposition offers better safety characteristics and an impressive reduction in waste material. Wire also has the benefit that every type of welding wire can be used for manufacturing.



Wire-based laser metal deposition
image: Jürgen Jeibmann, Fraunhofer IWS Dresden

The system is designed as a platform and can be reconfigured from 4-axis machining to 5-axis machining with relatively little effort. The AM Cube is equipped with cutting-edge sensors and meets all relevant safety requirements for operation without monitoring by the operator. If the AM Cube is used to machine particularly reactive materials such as titanium, the entire system can be flooded with protective gas to reduce oxidation, enabling manufacturing to be performed under a protective gas atmosphere for several hours.



Repairing a turbine blade using laser deposition welding; images: CHIRON

further information: ***www.chiron-group.com***

The «Dia-2200-Mini»

Now also for diamond tools with extreme axis angles up to 80°

Again, another innovation from LACH DIAMANT, discoverer of spark erosion for manufacturing diamond tools for the wood and composite industries as well as for mass-production in the automotive and aviation industries. Example: axis angles for diamond tools for processing wood and composites.

Not that long ago, these tools could only be produced up to an axis angle of 40°. New materials, such as high-gloss laminates used especially in the furniture and kitchen cabinet industry, and the recently emerging zero-joint technology forced not only the tool industry but also LACH DIAMANT, as a manufacturer of EDG sharpening machines, to face the challenges of new machining procedures.

With the continuous development of axis angles (this applies also for diamond tools) the industry succeeded to date in offering a solution up to 80°. It allows even the machining of extreme materials.

«Dia-2200-mini» during grinding operation - multiple manufacturing possible

LACH DIAMANT supports these manufacturing technologies, even as a manufacturer of special machines. As of today, a software update is available for the current «Dia-2200-mini» product line of LACH DIAMANT EDG (Electrical Discharge Grinding) eroding machines - sharpening machines; it allows for a transition to extreme axis angles up to 80°.

As of today, all «Dia-2200-mini» machines leaving the *Hanau* plant are already equipped with this additional programme - and at no extra charge as LACH DIAMANT would like to emphasize.

Moreover, nothing changes regarding the ease-of-use of the «Dia-2200-mini» as service and sharpening machine for polycrystalline diamond tools. Operators can rely on known and proven features, e. g. during tool measurement, whether eroding with carbon or copper.

«Dia-2200-mini» diamond sharpening machine for ultimate service and production of wood and composite tools, tried and proven several hundred folds

further information: **www.lach-diamant.de**

WALTER presents:

New modules for cleaning and laser marking of tools

The use of new modules for cleaning and laser marking of tools in the robot loader on the measuring machines HELICHECK PLUS and HELICHECK PRO further increases flexibility during manufacture and final inspection. The user saves valuable time by automatically loading the measuring machine with the robot loader and concurrently cleaning and laser marking the tools outside of the measuring area.

Tool cleaning module

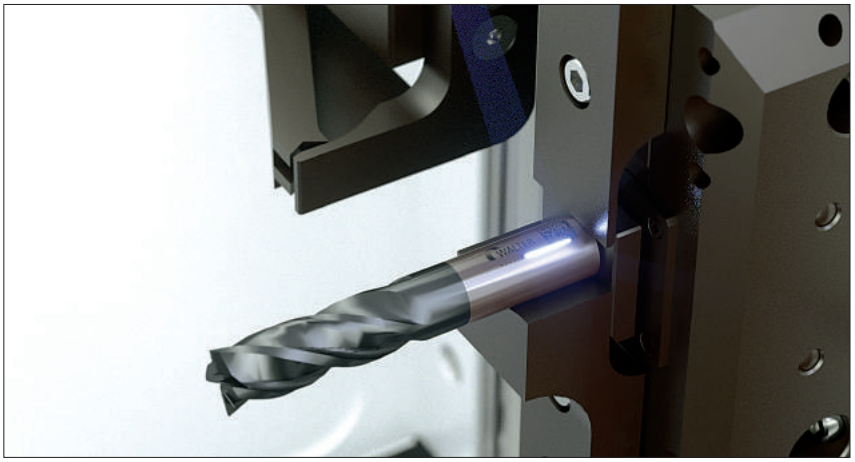
A clean tool is essential for a valid measurement of tools. Therefore, the tools are cleaned before measurement in an ultrasonic bath, which is integrated in the robot cell and separate from the measuring area. Tools are subsequently dried in an air stream, which can be adapted individually depending on the tool length.

Laser marking module

After cleaning and measuring the tool, the high-quality marking of the tool can then be carried out in the laser marking module, also integrated in the robot cell and separate from the measuring area without any penetration. Marking can be made on the shaft and/or tool end face with static or dynamic data.

For complete flexibility, the robot loader for the HELICHECK PLUS and HELICHECK PRO measuring machines can be specified with an individual preparation for these two modules - they can then be individually retrofitted if required.

Robot loader with the externally installed tool cleaning (1) and laser marking modules (2)



Laser marking on tool shaft

Tool in ultrasonic bath

A revolutionary laser machining center

Extraordinary results even when working with the hardest materials

Whether sintered cutting inserts, coins or small parts for watches - the result always requires the highest precision which has to last a long time. A challenge that the newly developed laser machining center "E1" by the startup KLM easily fulfills. The E1 provides extraordinary results even when working with the hardest materials, as demonstrated by various test customers. For example, the production time of sintered inserts was reduced from eight hours to two hours. Furthermore, the machine is also extremely easy to use and is available since February 2020.

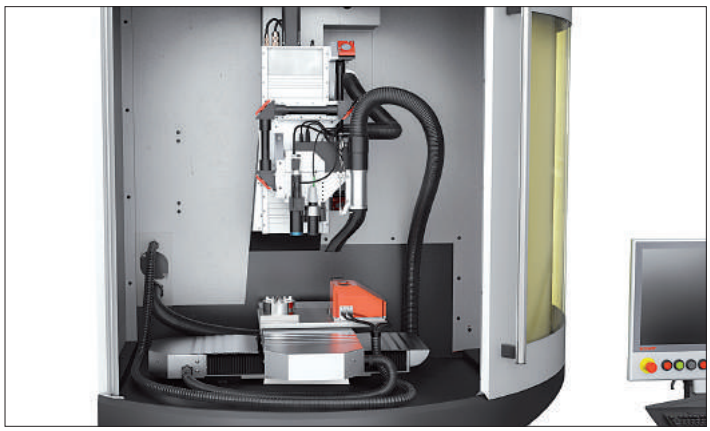
In 2017, the "E1" was still an idea by Ekkehard Alschweig - engineer, co-owner and former head of *KERN Microtechnik*. Two years later, he bundled his mechanical engineering knowledge with the know-how of the Dutch laser specialists from "Lightmotif B.V." and founded *KLM Microlaser GmbH* to realize his idea.

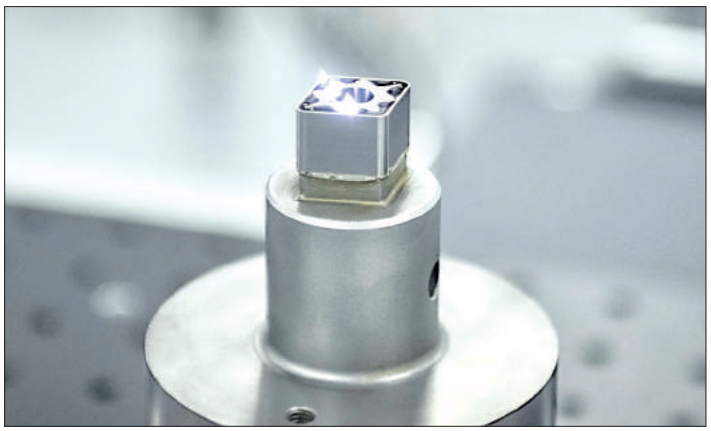
The KLM E1 is only available since the beginning of 2020, a modern high-tech laser machine that is particularly interesting for the mold and tool, watch and coin industries. When it comes to machining small parts, the KLM E1 is almost unbeatable in terms of productivity, long-term precision, freedom from wear, energy efficiency and usability.

KLM founder Ekkehard Alschweig explains important details about the KLM E1

According to Alschweig, several key components in the KLM E1 are decisive for this: "We use the basic construction, including the axes and drives of the established KERN-Evo

The newly developed "E1" from the Bavarian start-up KLM is a high-tech laser machine that shows its strengths when it comes to processing small parts; in particular, companies in mold, tool, watch and coin industries can significantly increase their productivity





The femtosecond laser emits light pulses, the duration of such a pulse is in the femtosecond range (1 fs = 10-15 sec.), its power is 20 W; with laser ablation, hardly any heat is brought into the workpiece and almost any material can be processed

milling machine, use an fs laser source, a mirror-based laser beam guidance from Lightmotif and have developed a software, which makes operation extremely easy." In order to penetrate new dimensions, particularly with regard to manufacturing accuracy, the young company has also developed two unique features: "ASPM" (Automatic Spot + Power Measurement) and "Adaptive Machining".

High-end mechanical engineering and femtosecond laser

A mineral cast stand in monobloc construction and an X-Y cross table, which is manufactured by KERN, are the solid basis of the KLM E1. They ensure the highest precision in the sub-µm range, which is important for positioning and measuring of the parts.

The material is removed by a laser - more precisely a *femtosecond* laser, or *fs* laser for short. It emits light pulses, the duration of which is in the femtosecond range (1 fs = 10-15 sec.). The femtosecond laser is already used for eye operations (e.g. cataracts). This already gives an idea of the precision and accuracy which can be achieved with such a laser source.

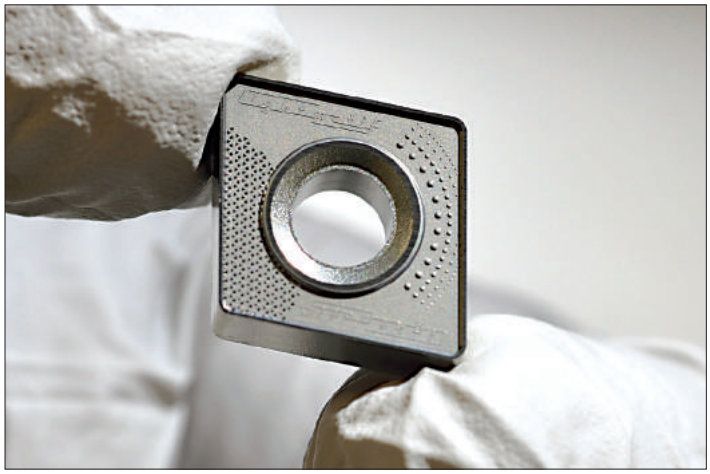
The KLM engineers use a mirror construction for the laser beam guidance. *Max Groenendijk,* Managing Director of Lightmotif, explains: "Optical fibers are not suitable for guiding fs lasers. That is why we guide the laser beam with mirrors that are attached to the machine frame, from the laser source to the scanner."

The power of the laser source is 20 W. This means that the KLM E1 can process a wide variety of materials. When the layers are removed, hardly any heat penetrates into the workpiece, because heat could cause a change in the material structure.

As with all fs laser systems, the removal depth of the E1 is low and is usually between 0.3 µm and 2 µm per layer. This leads to an extremely high precision and accuracy. KLM uses all the advantages of this technology, in particular with two features.

Automatic calibration compensates external influences

"ASPM" stands for "Automatic Spot + Power Measurement". It is a system that makes the machine stable over the long



A test customer reduced the production time of sintered inserts (left) from eight hours (with classic EDMing and milling) to two hours (with the KLM E1); another typical product for the E1: an unpolished stamp (right)

term. Ekkehard Alschweig explains: “Every machine - including ours - is subject to certain thermal and other influences, which do not have an immediate but a creeping effect - that is, over a certain period of typically a few hours. As a consequence, workpieces are then produced with less precision. We are talking about minimal influences and minimal inaccuracies, but we are preventing them.” When working with fs laser machines two main challenges with an effect on precision over a long term may arise.

First, the zero point of the laser spot can shift from its originally calibrated X-Y position, just in the µ-range but this is enough to cause inaccuracies. The reason for this is: the light guide mirrors for controlling the laser beam are mechanically attached to the machine frame. If heat is applied to the frame, the frame extends, the spot shifts and inaccuracies occur. As a result, the light guide mirrors have to be readjusted.

Second, the power of the laser when it reaches the workpiece can vary. The output power of a laser is never really stable, and in the long term, contamination on mirrors and lenses can also cause small losses. This means that after a certain time, the laser power originally calculated is no longer available. As a result, the removal of material changes.

With ASPM, the KLM E1 has a simple and efficient solution for these two potential challenges. ASPM can be started automatically or just with a push of a button. ASPM then recalibrates the entire system within just two minutes. Alschweig said: “If you rely on accuracy, just do the calibration every time production starts or even just once a day.”

Depth accuracy of < +/-5 µm

Another highlight of the E1 is “Adaptive Machining”. The fs laser removes material in the smallest layers of an average of 1 µm. The exact number is to be defined in individual cases. Adaptive machining optically measures the machined depth and compares the actual, measured values with the target values. The machine then adjusts the laser parameters accordingly and ensures that the target values are achieved.

Without “Adaptive Machining” the depth accuracy depends on the total machining depth and is usually off between +/- 3 % and 5 % of the machining depth. At a typical depth of 0.5 mm, this results in an expected inaccuracy of around +/- 25 µm. With “Adaptive Machining”, the depth accuracy is simply independent of the machining depth. The E1 achieves accuracies better than +/- 10 µm. “We even achieved values of less than +/- 5 µm in many tests,” adds Alschweig.

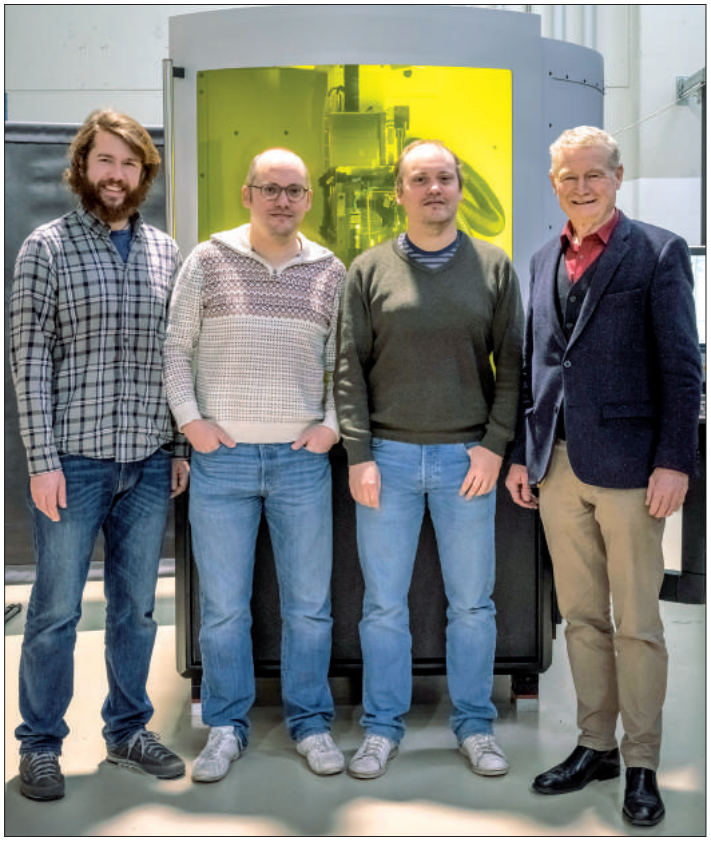
Simple transfer of CAD data and easy program start

Following the requests of numerous customers, KLM has developed the control and operator software of the E1. Neither has anything to do with traditional CNC. The new software is hard to beat, especially in terms of user friendliness. The complete CAD/CAM process runs automatically. This means that the data of the CAD program can be transferred directly to the machine control. No additional computers and imports are necessary

“It is important that the CAD model covers 100 %,” Alschweig emphasizes: “If individual points in the model are not connected, of course our machine cannot implement them. We recommend that users always check their customers’ CAD programs.” If the 3D models fit, the volume to be removed is generated in CAD - this only takes a few minutes - and then the machine only has to be set up and a few steps later the fully automated production can begin. Of course, this set-up process only needs to be done once per CAD model. Compared to creating an NC program for milling, the process is simple and very fast.

Results of test customers: production times reduced by 75 %

Several test customers are already very satisfied with the result. For example, a manufacturer of cutting inserts used to work with an EDMing and a milling process. Now they have converted the traditional process for press punches to produce blanks in green state carbide. With the new KLM E1 they only run one process. The result is clear: the pressing tools were previously produced within an average of eight hours, now only two hours are needed.



The basis for the KLM E1 is the know-how of mechanical engineers and laser specialists; in addition to Ekkehard Alschweig (right), Simon Fischer (both KLM), Ronald and Martijn Sipkema (from left to right, both Lightmotif B.V.) have a large part in it; not in the picture: Max Groenendijk (GF Lightmotif)

further information: ***www.klm-microlaser.com//www.lightmotif.nl***

BLOHM PROFIMAT XT with tool changer

Unsupervised processing possible

benefits at a glance:
- automated production
- more efficient machining
- automatic operation of complex work pieces
- option to load sister tools
- setup while process is going on
- simplified handling

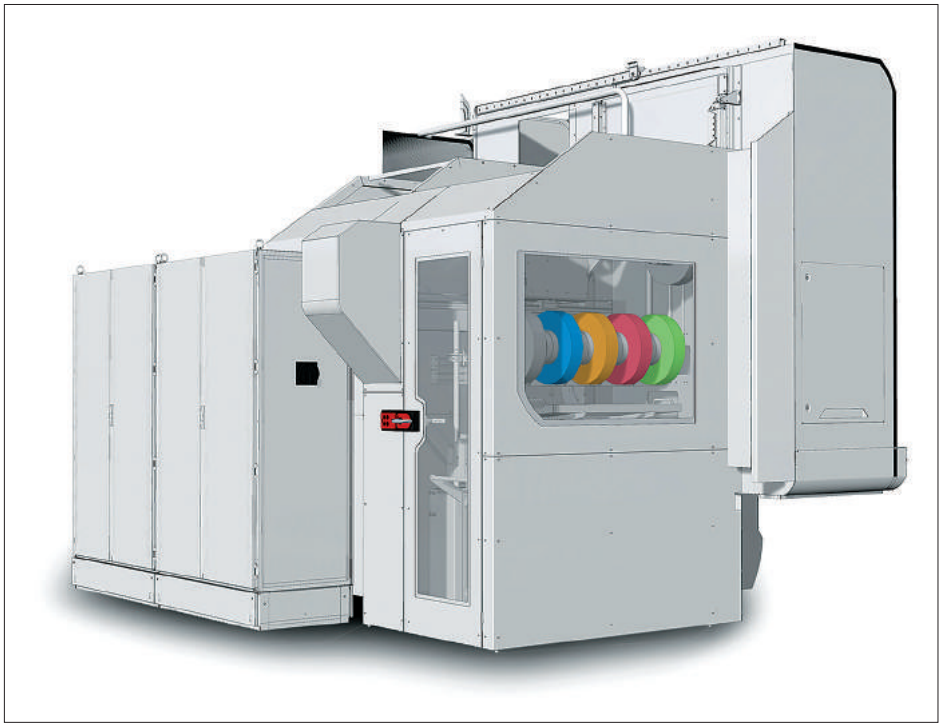
key tool changer data:
- magazine with four grinding wheels
- max. grinding wheel Ø: 400 mm
- max. grinding wheel weight: 40 kg

The cost-efficient solution to automatically change grinding wheels is one-of-a-kind in this market segment.

Highly productive, flexible PROFIMAT XT merges four grinding technologies in one machine: reciprocate, creep feed, CD and speed stroke grinding. Thanks to the tool changer these pro-cedures can now be automated.

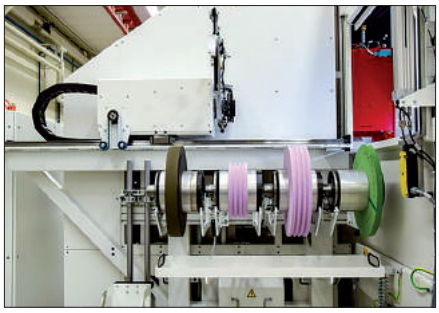
In this process, the changer offers users other benefits: it can be loaded with several tools of the same type to be able to quickly and automatically replace worn grinding wheels. The tool changer also makes unsupervised processing possible, even of complex workpieces requiring grinding wheels with different profiles. Setup times are additionally cut as the unit can be loaded while the process is going on. The tool changer also improves general machine handling because it is easier for workers to load the changer with large grinding wheels than directly fit these in the machine themselves.

Users also benefit from significantly more efficient machining. For instance, roughing or finishing grinding wheels can be prepared in the changer to thus achieve a high abrasion performance and an accurate level of detailed surface machining as part of a single process.

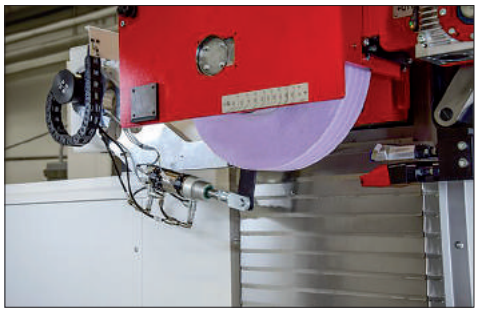


PROFIMAT XT with tool changer

Loading device



Magazine with four wheels



Changing of grinding wheel

further information: **www.blohmjung.com**

Three-dimensional inspection of parts in real time

ZeroTouch measuring platform

Introducing *ZeroTouch* - a high-speed metrology and inspection system that processes complex geometries faster than traditional inspection methods.

Conventional measurement systems such as coordinate measuring machines (CMMs) are typically utilized for quality control in various industries. Most traditional contact based inspection systems are characterized by long measurement cycle times. Changeovers to measure other parts and the attendant programming also add to the delay. Further, contact based measurement technologies are not suitable for generating large amounts of data points required for complex surfaces. Because of these limitations, systems like CMMs are not an ideal solution for 3D inspection on the production line. To solve these problems, *DWFritz Automation* has developed the ZeroTouch measuring platform. The system uses multiple non-contact sensor technologies to rapidly measure in three dimensions and in real time. ZeroTouch's proprietary software then creates a highly accurate dense 3D point cloud. In addition, by simplifying complicated programming procedures, ZeroTouch reduces the system configuration time to just a few hours saving substantial production time and costs.

"Quality control is critical in production operations," explains *David Mendez,* vice president of the ZeroTouch business unit at DWFritz Automation. "Preparations, such as programming, as well as the measuring process itself, often take a great amount of time and result in high costs. In addition, inspection tasks requested for manufacturing often collide with other measurement requests such as those from other manufacturing lines, pre-production tests or even R&D". The measurement platform developed by DWFritz features a 5-axis architecture that captures millions of data points per second in a single scan to create a dense 3D point cloud. The system enables the rapid measurement of complex part geometries and precise inspection of the most complicated parts with high repeatability.

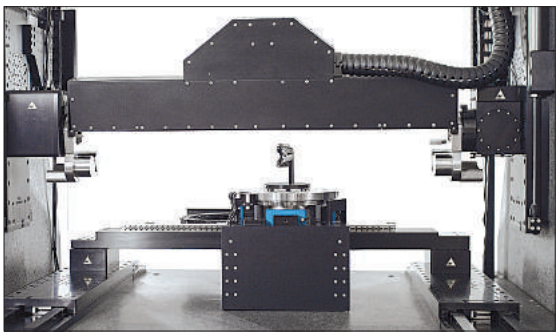
The system uses a unique planar air bearing design that minimizes tolerance stack error. The near-zero friction design provides extremely smooth, high-speed motion of precision stages and improves gage repeatability & reproducibility (GRR). In contrast, tactile probes typically operate at slower speeds as they require physical contact with the part surface. Contact measurements are primarily limited to 2D scans - typically generating sections or contours whereas ZeroTouch can generate complete 3D surfaces with an accurate and dense grid of data points. Acquisition of the data points is extremely rapid, at a rate of up to 4 million points/s. In addition, the system combines various technologies such as laser and chromatic confocal sensors with high-resolution cameras with multi-spectral illumination. Further, the user has flexibility in choosing the right sensing technologies to get the most optimal measurement results. For example, shiny or specular surfaces will require specific sensors such as white light confocal or interferometric sensors. On the other hand, laser profile sensors may be needed for surfaces with "matte" like finishes.

Metrology platform that is significantly faster than conventional systems

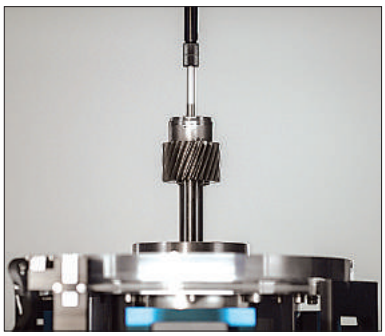
During the development of ZeroTouch, special attention was given to problems that conventional CMMs face: obtaining quick, accurate and reproducible results to keep pace with manufacturing cycle times. Most traditional inspection systems have issues specifically with speed, ease-of-use and machine availability. As a result, traditional measurement technology does not lend itself to inline inspection or even fast sampling.

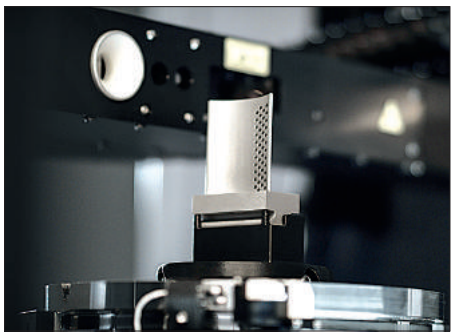
Providing the operator a tool that is easy to use to perform rapid quality checks of various types of parts pro-

DWFritz Automation was founded in 1973 by Dennis Fritz and is headquartered in Oregon, USA. The company started out by offering engineering services, and by the 1980s counted global brands like HP, Intel, and Boeing among its clients. In the 1990s, DWFritz Automation focused increasingly on the development and manufacture of high-precision automation and metrology systems for many industries, including aerospace, medical technology, mechanical engineering, automotive, and consumer electronics.



The sensor bridge is configurable, allowing the most optimal and appropriate sensor selections to suit the part and surfaces, in addition to the complex dimensions being measured





The sensors can be configured to the specific GD&T measurements and the part, and in one scan can capture data points to create a high-density 3D model

duced by different lines is vital to ensure the qualification of manufacturing lines, in addition to speeding up the production ramp. CMMs are typically located in environmentally controlled inspection rooms, which often impact machine availability. If the parts are to be inspected in the metrology room during the production process, part "queues" are to be expected, due to limited machine availability coupled with long CMM setup times.

ZeroTouch has been designed precisely to mitigate these issues, being fast, flexible, easy to use, and compatible with the manufacturing environment.

ZeroTouch enables 100% part inspection. In addition, the ZeroTouch is characterized by its ease of use. By giving the operator an easy-to-use tool, different types of parts produced on different lines can be quickly inspected. Such capability will enable the rapid qualification of manufacturing lines and speed up production ramp.

ZeroTouch's unique architecture features five independent axes; a rotating bridge - Gonio like - equipped with multiple, non-contact sensors, including lasers and chromatic confocal sensors, which dramatically increase inspection speeds in measuring the entire part surface, as there is no sensor change time. The sensor bridge is configurable allowing for the most optimal and appropriate sensor selections to suit part geometries and surfaces, in addition to the complex dimensions being measured. Such innovations associated with a horizontal rotary table and three translation axes result in higher throughput of parts and increased capacity, enabling 100% in-line inspection rather than just sampling.

The innovative design of ZeroTouch presents a remarkable improvement in surmounting the challenge of repeatability in a hostile manufacturing environment. Since it can perform multiple measurements in parallel using different sensors, parts and assemblies can be analyzed significantly faster than a conventional CMM.

"The sensors can be configured to the specific GD&T measurements and the part, and in one scan the system can capture data points to create a high-density 3D model," says Mendez. "This makes it possible to measure objects made of a wide variety of materials with complex geometries, including holes, undercuts, bevels, and surfaces, quickly and with micrometer precision. At the same time, the system provides very high reproducibility and repeatability of results."

The various non-contact sensors on the metrology bridge can be easily calibrated by software directly via the metrology platform. Further time is saved by the simplicity with which parts and assemblies can be placed on the measuring table, instead of requiring complex positioning fixtures. This, not only decreases the metrology preparation time but also enables direct cost savings in fixture design, development and management.

"It was also important that ZeroTouch shows no signs of wear, and delivers the same performance year after year," says Mendez. "So we gave it a planar air bearing system". The moving parts, such as the measurement platform and sensors, generate virtually no friction during the measuring process. Part inspection plans can be created within a few hours and stored in the manufacturing execution system (MES) for management and retrieval. "The user is assisted by menu-guided intuitive tools, making deep programming knowledge superfluous now," says Mendez. "Instead, inspection plans can be prepared using drag-and-drop functions."

Measurement data for each component is retained to ensure data integrity. Thereafter, component-specific plans can be accessed in the MES for fast measurement.

Software with integrated analysis tools for faster quality control

The three-dimensional point cloud can be analyzed immediately after the measurement process. Integrations to proven analysis tools enable the accurate comparison of the scan results with part CAD models or a reference part previously scanned and measured to not only check for geometric and dimensional tolerances, but for other previously undetected issues such as surface aspect defects.

further information: ***www.dwfritz.com***

umati - on its way to becoming the global language of production

Mechanical and plant engineering sector propelling industry towards Industry 4.0

The VDMA *(German Engineering Federation)* and VDW *(German Machine Tool Builders' Association)* are joining forces to promote the use and dissemination of OPC UA standards throughout the mecha nical engineering sector under the umati label.

"Cross-industry and cross-technology marketing will take our customers a significant step forward," said Dr. *Wilfried Schäfer,* Executive Director of the VDW, explaining the strategy at the associations' joint press conference in Frankfurt am Main.

"Manufacturing companies have not only machine tools but also their own individual mix of machines, equipment, robots and systems. If all these technologies can exist in a common ecosystem which is ideal for producing plug-and-play solutions, this will save end users a lot of time and money," Schäfer continued. *Hartmut Rauen,* Deputy Executive Director of the VDMA, added: "Over thirty specialist groupings in more than 17 associations are working on technology-specific interfaces, the *Companion Specifications*. This high level of collaboration forms the basis of true, open interoperability between machines and software systems, from the shop floor to the cloud. Only the VDMA has the means to unite the necessary integrative forces from the wide range of production domains."

OPC UA *Companion Specification for Machinery* to be published in 2020

The mechanical and plant engineering sector adopted OPC UA as the standard for data exchange from an early stage. This is because OPC UA provides a uniform framework for machine and system interoperability. Having adopted a bottom-up approach, it became clear how important it was to have uniform definitions for basic elements for a large part of the diverse range of products in mechanical and plant engineering. The simplest example is machine identification, including features such as manufacturer, serial number, year of manufacture and machine type.

Here, various VDMA departments - such as *Electrical Drive Engineering, Plastics and Rubber Machinery, Machine Vision, Metallurgy, Robotics and Machine Tools* - are currently drawing up the basic Companion Specification OPC UA for Machinery. "The first version is scheduled for publication later this year," announced Hartmut Rauen.

umati aimed at end customers

The machine tool industry was also at the forefront of this process. An initiative to develop an open, standardised interface was presented back in 2017. Here, too, an early decision was taken in favour of OPC UA as the base technology. Just two years later, a showcase featuring seventy partners from ten countries demonstrated at *EMO Hannover* that it was possible to connect 110 machines to 28 software services distributed across the exhibition grounds in a system which functions to all intents and purposes on a "plug and play" basis. In addition, the VDW launched the umati - *universal machine tool interface* label back in 2018, a brand aimed primarily at customers all over the world.

In the meantime, numerous other OPC UA Companion Specifications have been developed by the VDMA and its partner organisations. In order to give these specifications greater visibility and to increase their usage levels, umati is now being extended to cover the entire mechanical and plant engineering industry as a community for the use and marketing of OPC UA Companion Specifications.

The new name umati (universal machine technology interface) represents a performance promise of interoperable production. umati is a brand and label for a community that has come together to propagate the OPC UA standards within the mechanical and plant engineering sector. It provides a framework for joint marketing, public relations, demonstration of use cases and for end customer communication. It is based on the OPC UA interface standardisation in various branches of mechanical and plant engineering. "That is why in the future we will always be referring to the latest version of the OPC UA Companion Specification for Machine Tools", explains Wilfried Schäfer from the VDW.

The next steps include further optimisation of the relevant Companion Specifications, dissemination of the respective standards, and the staging of showcases at trade fairs. The umati showcases highlight the cross-industry use of various OPC UA standards in a practical way, aimed at demonstrating the suitability of OPC UA standards for everyday use in production to the diverse range of customers.

"We expect to see the first concrete products based on the OPC UA Specification for Machine Tools providing connectivity to customers in the second half of this year," said Schäfer.

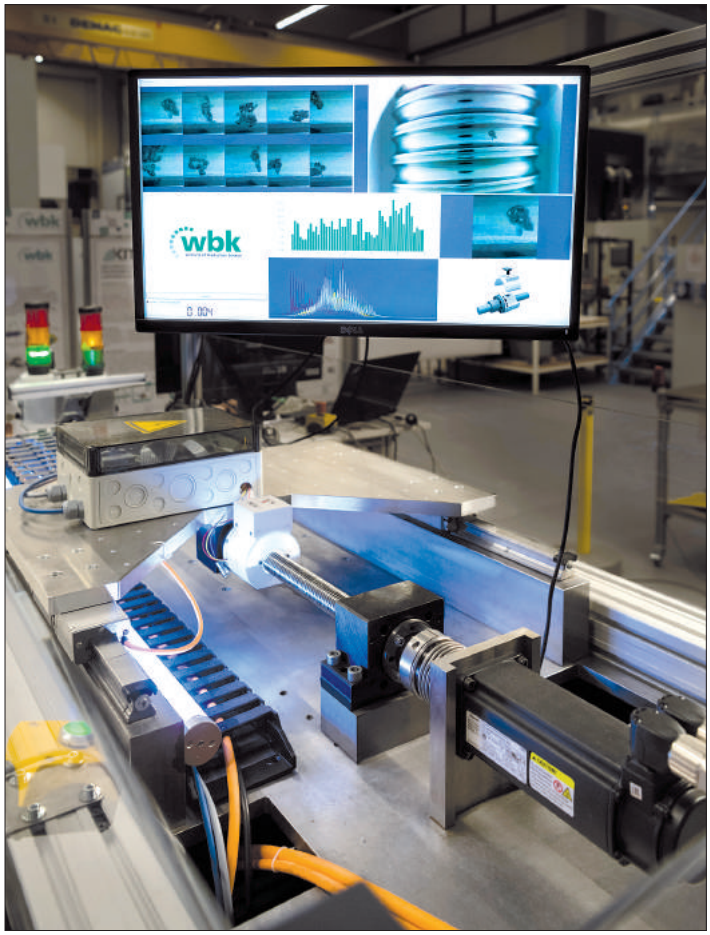
further information: ***www.vdw.de***

Artificial intelligence for machine tool maintenance

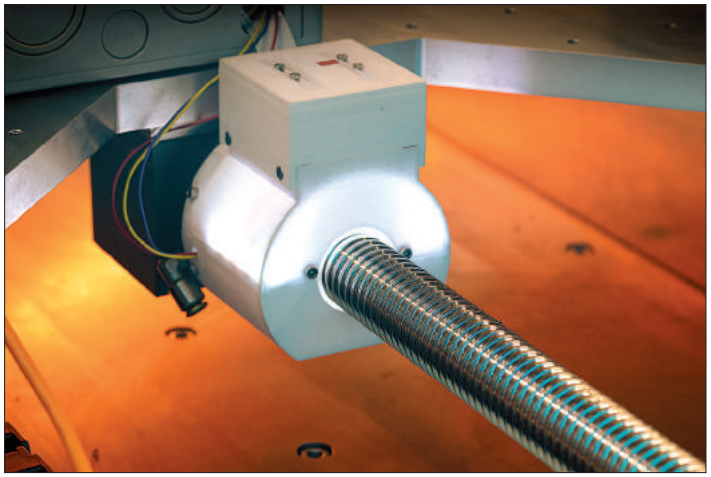
No more machine standstills

Researchers at the Karlsruhe Institute of Technology (KIT) have developed a system for fully automated monitoring of ball screw drives in machine tools. A camera integrated directly into the nut of the drive generates images that an artificial intelligence continuously monitors for signs of wear, helping to reduce machine downtime.

In mechanical engineering, maintaining and replacing defective components timely in machine tools is an important part of the manufacturing process. In the case of ball screw drives, such as those used in lathes to precisely guide the production of cylindrical components, wear has until now been determined manually.



System developed at KIT for fully automatic wear control of ball screws by using artificial intelligence photo: Markus Breig, KIT



An integrated camera with lighting enables continuous monitoring of the spindle in the ball screw drive photo: Markus Breig, KIT

"Maintenance is therefore associated with installation work, which means the machine comes to a standstill," says Professor *Jürgen Fleischer* from the Institute for Production Technology (wbk) at the Karlsruhe Institute of Technology (KIT). "Our approach, on the other hand, integrates an intelligent camera system directly into the drive, which enables a user to continuously monitor the spindle status. If there is a need for action, the system informs the user automatically."

The new system combines a camera with light source attached to the nut of the drive and an artificial intelligence (AI) that evaluates the image data. As the nut moves on the spindle, it takes individual pictures of each spindle section, enabling the analysis of the entire spindle surface.

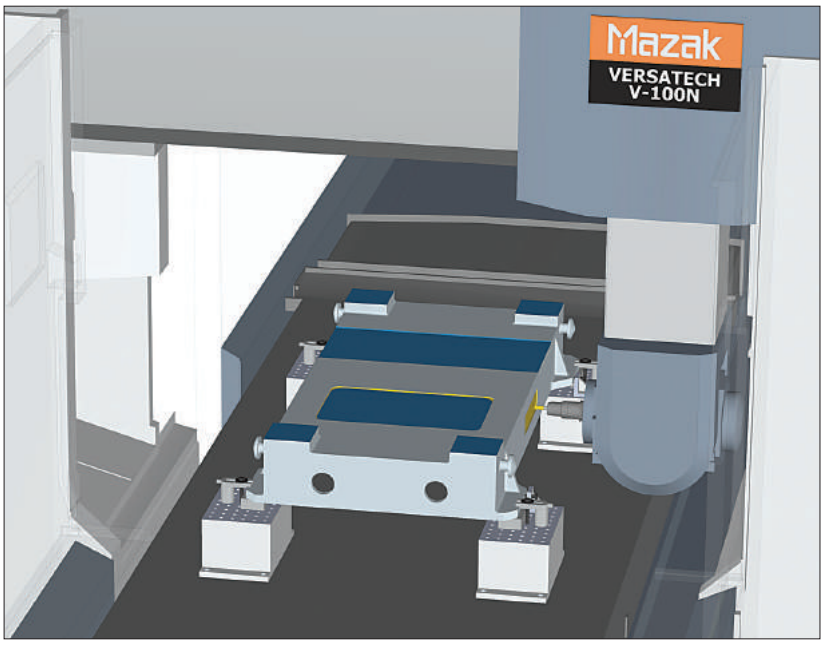
Artificial intelligence for mechanical engineering

Combining image data from ongoing operations with machine learning methods enables system users to assess directly the condition of the spindle surface. "We trained our algorithm with thousands of images so that it can now confidently distinguish between spindles with defects and those without," says *Tobias Schlagenhauf* (wbk), who helped to develop the system. "By further evaluating the image data, we can precisely qualify and interpret wear and thus distinguish if discoloration is simply dirt or harmful pitting." When training the AI, the team took account of all conceivable forms of visible degeneration and validated the algorithm's functionality with new image data that the model had never seen before. The algorithm is suitable for all applications that identify image-based defects on the spindle surface and is transferrable to other applications.

further information: **www.kit.edu**

DP Technology announces long-awaited product update

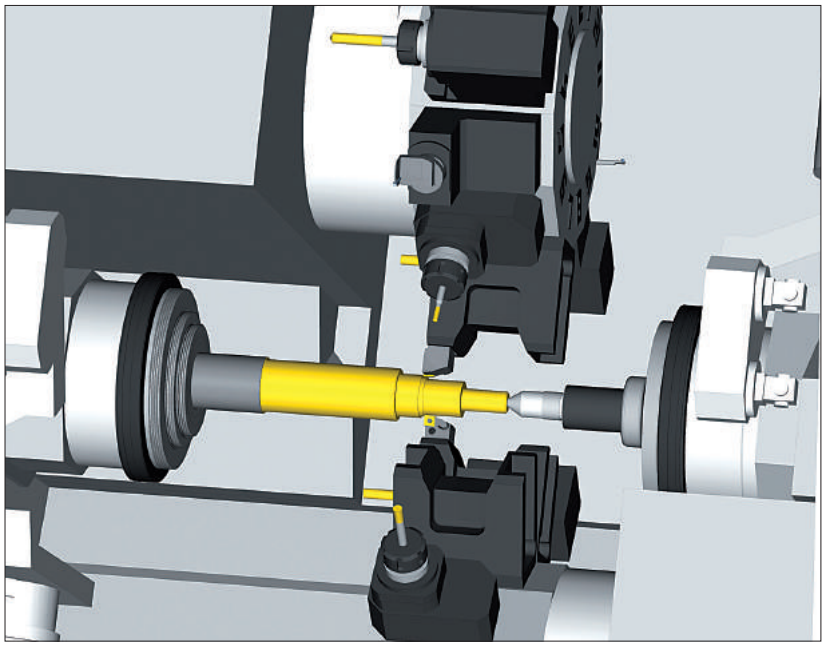
Simultaneous cuts now possible



DP Technology, leaders in computer-aided manufacturing (CAM) software, announce a new update to their popular ESPRIT CAM system. The new ESPRIT includes new features such as a balanced turning cycle, as well as enhancements to existing features such as probing and additive directed-energy deposition (DED).

The balanced turning cycle unlocks new capabilities for lathe users, including the ability to use two tools to make simultaneous cuts to the same workpiece, automatically synchronizing passes between tools. The feature reduces cycle times by taking heavier cuts with pinch turning, using lead and trailing tools to cut two depths at once. Balanced turning can also rough with one tool and finish with the second. Finally, the feature reduces stock deflection on long, slender parts, ensuring consistency.

The expanded probing features of the new ESPRIT are also notable. Using a 4th-axis measurement, 5-point rectangle, angled surface and angled web/pocket, it improves the intelligent cycle selection by supporting more advanced scenarios. These updates allow users to increase automation, reducing human intervention and therefore human error.



Improvements to additive DED allow manufacturers on the forefront to further expand their capabilities. A dedicated approach for additive trajectories, this update manages dwell time for pauses between layers.

"Although each new feature offers a discrete set of benefits to users, combining them into one large release helps keep our software on the cutting edge and minimize disruptions in our customers' shops," says *Tania Campanelli,* Director of Research and Development for DP Technology. "Each new product release brings a host of attractive features that can help set these shops apart from the competition," says Campanelli. "In this version, users can enjoy features including coolant improvement, drilling interrupted holes, collinear axes, and other ways to expand their capabilities."

By improving throughput on existing machine tools, the new ESPRIT enhances a shop's capabilities, offering users a distinct advantage in competitive industries.

further information: ***www.espritcam.com***

ZYFRA presents its AI predictive maintenance software

ZYFRA has presented its innovative *Predictive Maintenance* (PM) solution for discrete manufacturing at EMO 2019. The software is a part of ZYFRA's MDCplus system and predicts remaining useful tool life. The solution helps to reduce unplanned downtime by 10% by detecting anomalies in technological processes and predicting equipment failures.

ZYFRA is among the pioneers offering a PM solution to the market which, unlike other solutions of its kind, does not require installation of any additional sensors.

"Downtime is very costly, as failure of functional equipment can lead to productivity and efficiency losses. The PM solution helps to identify defects or predict failures such as a worn spindle, thereby helping eliminate faulty products and avoid financial losses," said Ilkka Saarinen, sales director of Nordic markets at ZYFRA.

The software is based on AI technology. ML models use data from the CNC, find correlations between different parameters and give a prediction of tool life. The key aspect of this solution is data. It has to be historical, so the algorithms can see the whole tool lifecycle, and also complete, meaning it should contain crucial parameters (cutting parameters, spindle load, spindle and feed speed as a minimum). For example, based on historical data for one month, the model can give a prediction of tool life on a 15-minute horizon with 85% prediction accuracy.

The essential platform for collecting and storing this data is ZYFRA's IIoT-based MDCplus, which is a real-time machine monitoring and manufacturing data collection system. The advantage of the solution is that it measures not only superficial operational parameters like temperature or power consumption, but also deeper ones such as spindle rotation rate within a specified work shift timeframe.

At EMO 2019, Andrey Lovygin, ZYFRA's international business development director, presented the Predictive Maintenance module at the *New Technologies - Future Opportunities* forum. In his presentation, he talked about Industrial AI as a development of Industrial IoT ideology and explained how it can provide added value for manufacturing companies.

ZYFRA was founded in November 2017. The company develops and invests in industrial digitalization technologies, and is improving the *Industrial Internet of Things* and *Artificial Intelligence* environment. ZYFRA's key target sectors are the machinery, metallurgy, mining, oil & gas, and chemical industries. ZYFRA promotes readymade industry solutions in predictive analytics and data analysis, tech process optimization, and machinery and floor staff monitoring.

"IoT Analytics predicts that the Predictive Maintenance market will grow from USD 1.49 bn in 2016 to USD 10.9 bn in 2022. At present, however, Predictive Maintenance solutions do not have a significant presence in discrete manufacturing. While holding a leading position in IIoT implementation (according to IoT Analytics, spending on IIoT platforms for discrete manufacturing will account for 53% of the total), discrete manufacturing is lagging behind in terms of AI application. AI based solutions in the sector are more like research projects than working products. ZYFRA has connected over 8,000 machine tools. As a result of our work, with all the data now accumulated, we are able to offer the market our new Predictive Maintenance solution", said Andrey Lovygin.

At EMO Hannover, ZYFRA also officially announced its expansion into Turkey, having signed an agreement with *TANDEN TAKIM TEZGAHLARI,* a large turkish distributor of CNC machines. In 2019 the company has already entered the markets of Peru, Chile, Malaysia and France, and is currently operating in over ten countries around the world.

further information: ***www.zyfra.com***

impressum

ISSN 2628-5444

Publisher
Benno Keller
tel: + 49 (0)911 2018-200
fax: + 49 (0)911 2018-100
keller@harnisch.com

Editor-in-chief
Eric Schäfer
tel: +49 (0)911 504 98 82
fax: +49 (0)911 506 38 32
eric.schaefer@harnisch.com

Managing Editor
Christiane Ebner
tel: +49 (0)911 2018-260
fax: +49 (0)911 2018-100
ebner@harnisch.com

Editor
Tanja Pinke
tel: +49 (0)911 2018-130
fax: +49 (0)911 2018-100
pinke@harnisch.com

Publishing Company
Dr. Harnisch Publications
Management board
Dr. Claus-Jörg Harnisch
Benno Keller
Eschenstrasse 25
90441 Nuremberg
Germany
tel: +49 (0)911 2018-0
fax: +49 (0)911 2018-100
hpt@harnisch.com
www.harnisch.com
www.hptooling-mag.com

Advertising *Germany, Austria, Switzerland*
Thomas Mlynarik
tel: +49 (0)911 2018-165
tel: +49 (0)9127 902 346
mobil: +49 (0)151 548 181 81
fax: +49 (0)911 2018-100
mlynarik@harnisch.com

Advertising *Europe*
Britta Steinberg
tel: +49 (0)2309 574 47 40
mobile:+49 (0)176 478 601 38
fax: +49 (0)911 2018-100
steinberg@harnisch.com

Advertising,
North American editor *USA, Canada*
Bill Kaprelian
tel: +1 262 729 2629
kaprep@harnisch.com

Advertising *China, Hong Kong, Taiwan*
Mike Hay
tel: +852 9096 8895
mchhay@ringier.com.hk

Advertising *Taiwan*
Sydney Lai
tel: +886 (0)4 232 973 18
sydneylai@ringier.com.hk

Number of issues 2020
four issues per year

Printed by
Schleunungdruck GmbH
Eltertstrasse 27
97828 Marktheidenfeld, Germany

Bank account
HypoVereinsbank AG, Nuremberg, Germany
IBAN: DE45 7602 0070 0000 6147 18
Swift-Code: HYVEDEMM460
VAT DE 133 510 873

The articles contained in this magazine, including the illustrations, are subject to copyright law. Any use without the consent of the publisher is not permitted and will be prosecuted. This applies to every conceivable form of reproduction. Copies and reprints can be ordered on request. Articles which are identified by name or which are to be assigned to an author by an abbreviation do not necessarily reflect the opinion of the editorial staff. Unsolicited manuscripts cannot be returned. If a manuscript is accepted by the editorial staff, publishing and copyright law as well as all rights for publication and distribution are transferred to the publisher. The publisher accepts no liability with regard to the facts set out in these articles.

We've got the go for *GrindTec 2020*

On Tuesday, May 26, the *Bavarian Ministry of Economic Affairs* announced further steps to open up the economy: as of September 1, trade fairs can also be held again in Bavaria. This is the starting signal for GrindTec 2020.

"The course has been set for GrindTec 2020," said Henning and Thilo Könicke, Managing Directors of GrindTec organiser *AFAG Messen und Ausstellungen*. "We will use the coming six months to the trade fair intensively in order to be able to present the world's leading trade fair for grinding technology in accordance with the safety and hygiene standards that then will be mandatory".

From September on trade fairs can take place again, the final confirmation for GrindTec 2020, which will take place as planned November, 10th to 13th, 2020 at the Augsburg Trade Fair Center. AFAG considers itself well prepared. By autumn, the safety and hygiene concept is to be tested for its practical suitability and adapted to current conditions.

There has been a pleasing development with regard to exhibitor participation at GrindTec 2020: since the postponement of the trade fair there have been some cancellations by exhibitors due to scheduling, but these have already been compensated for by new registrations. At present there are approximately 670 exhibitor registrations.

further information: ***www.grindtec.de***

company finder

editorial

advertising index

CERATIZIT GROUP

Machining professionals choose MultiLock

The exchangeable head system for advanced users reduces tool costs and increases performance

Find out more at:

cutting.tools/en/multilock

TEAM CUTTING TOOLS

CUTTING SOLUTIONS BY CERATIZIT · KOMET · WNT · KLENK

CERATIZIT is a high-tech engineering group specialising in cutting tools and hard material solutions.

Tooling the Future

www.ceratizit.com

Stop long Chips

»IC-plus« world´s best (pat.)

Chipbreaker

World Premiere

Best chip control for turning aluminium

LACH DIAMANT®

www.lach-diamant.de