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FACTS

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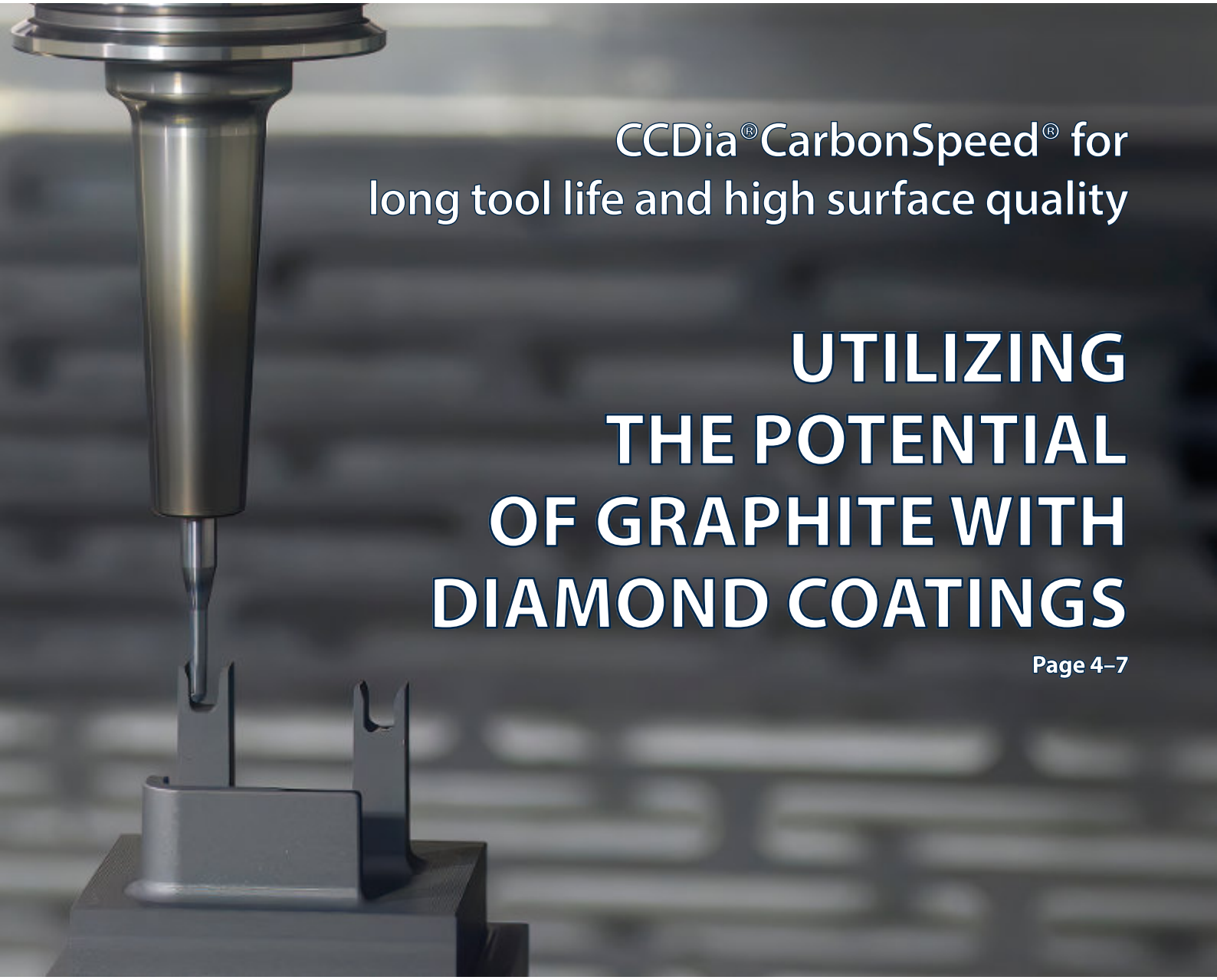

CCDia®CarbonSpeed® for long tool life and high surface quality

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THE RIGHT CHOICE FOR A PRECISION TOOL

CARBIDE IN FOCUS

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"The world of MACHINING is changing.
High-performance PRECISION TOOLS tailored
to the application are essential in order
to stand out from the competition
and score points in the promising markets of the future,
especially in these difficult economic times.
With our PREMIUM COATINGS – whether HiPIMS or
diamond – the performance of cutting tools can be
significantly increased. Through continuous innovation
and our tailor-made solutions, we support
tool manufacturers in achieving
TOP PERFORMANCE in demanding machining tasks."

Dr.-Ing. Oliver Lemmer, CEO CemeCon AG

The CemeCon Management Board (from left): Dr.-Ing. Beate Hüttermann, Dr.-Ing. Oliver Lemmer and Bernd Hermeler

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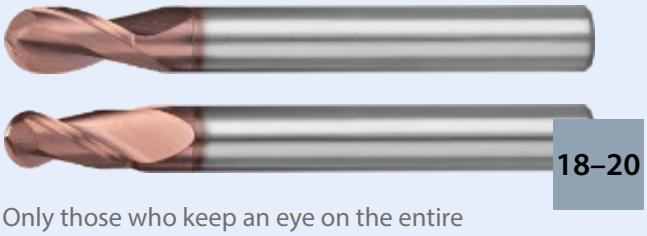

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Only those who keep an eye on the entire process chain of tool production can obtain coordinated precision tools for the highest demands

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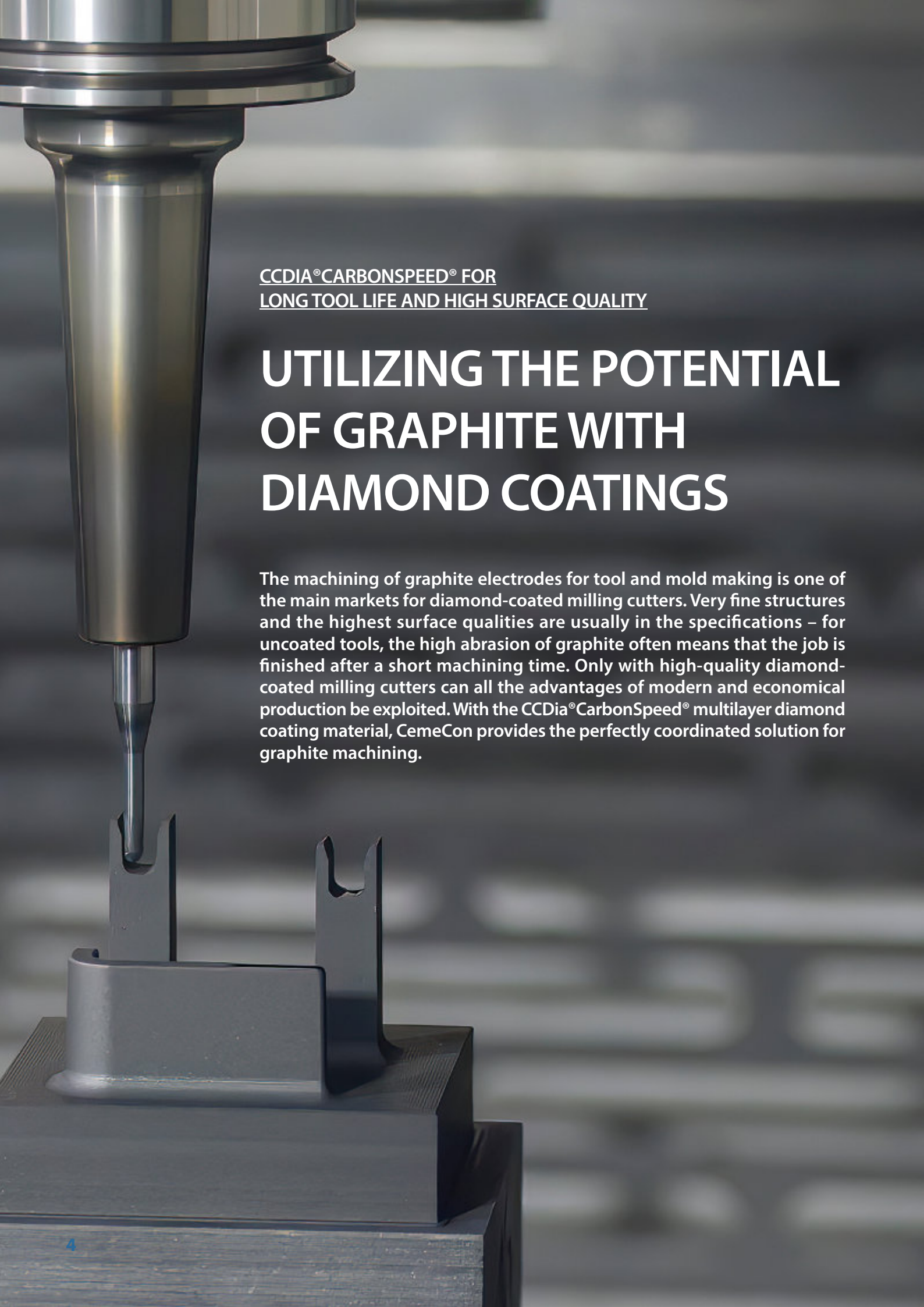


CCDIA®CARBONSPEED® FOR
LONG TOOL LIFE AND HIGH SURFACE QUALITY

UTILIZING THE POTENTIAL OF GRAPHITE WITH DIAMOND COATINGS

The machining of graphite electrodes for tool and mold making is one of the main markets for diamond-coated milling cutters. Very fine structures and the highest surface qualities are usually in the specifications – for uncoated tools, the high abrasion of graphite often means that the job is finished after a short machining time. Only with high-quality diamond-coated milling cutters can all the advantages of modern and economical production be exploited. With the CCDia®CarbonSpeed® multilayer diamond coating material, CemeCon provides the perfectly coordinated solution for graphite machining.

Graphite has already established itself as an electrode material in die and mold making. This is the specialty of CIMTRODE GmbH. Starting out as an electrode manufacturer, CIMTRODE is now a technology and development expert as well as a source of ideas in the field of graphite. As company founder and the brains behind CIMTRODE, Daniel Gruber is very familiar with the positive properties of the material in die and mold making: "Graphite offers many advantages over copper, which have a direct positive effect on the cost-effectiveness of electrode production and the eroding process – no manual reworking, no deburring, hardly any burn-off, and the electrode comes out of the milling machine ready to be eroded. This has enormous savings potential for many users and also generally increases the dimensional accuracy and ultimately the quality of the products to be manufactured." Another major advantage are the design options: Graphite does not have a melting point, but only changes to a gaseous state at around 3,750 °C. This makes it very heat and dimensionally stable. This enables filigree and complex electrode geometries, which can be realized with enormous variability thanks to HSC milling technology.

SUCCESSFUL GRAPHITE MACHINING WITH CCDIA®CARBONSPEED®

"Only with the use of diamond coatings for the corresponding precision tools can we fully exploit the enormous potential of graphite. Graphite is highly abrasive; how much depends on the grain size: For example, very fine graphite with a grain size of up to 1 µm is used for sizing electrodes. This results in very high abrasiveness, which makes machining extremely difficult. Without effective wear protection for the carbide tools, this is hardly economically feasible," explains Daniel Gruber.

CemeCon is a pioneer in the field of diamond coatings and has developed the diamond coating material CCDia®CarbonSpeed® especially for machining graphite. Manfred Weigand, Product Manager Round Tools at CemeCon, explains: "CCDia®CarbonSpeed® is particularly wear-resistant. As a multilayer, our diamond coatings also have 'crack-stopping' properties that prevent the total failure of the tool due to such damage. At the same time, the lower thermal conductivity of the diamond coating protects the carbide."

When machining graphite, the new coating material delivers outstanding results with the best surface finishes and the tightest tolerances: When machining EDM graphite ISO-63 (v_c = 600 m/min; f_z = 0.06 mm/tooth), a CCDia®CarbonSpeed®-coated milling cutter (400 m) increases the tool life twenty-fold compared to an uncoated tool (20 m). The CemeCon solution also scores well in a tool life comparison with other diamond coatings: When milling graphite with the same parameters, CCDia®CarbonSpeed® lasted around 28 percent longer compared to a nanocrystalline coat-

ing, and around 48 percent longer compared to the crystalline coating.

Wet processing of graphite opens up new possibilities for precision applications in electrode production

PRECISION EVEN IN THE SMALLEST DIMENSIONS

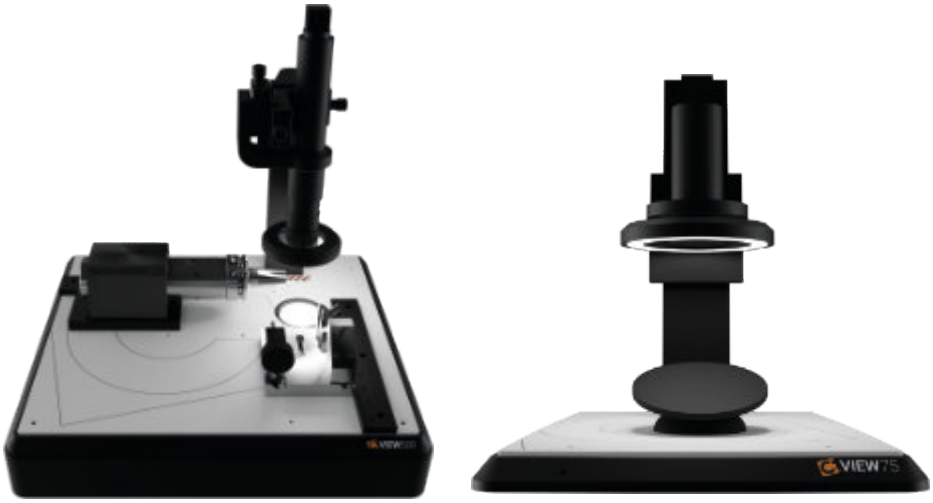
Tools with extremely small diameters from 0.1 mm are increasingly being used in graphite machining in order to maintain the fine contours and ever tighter tolerances. When designing high-end micro-tools for the production of highly complex graphite electrodes, the combination of specially selected carbide grades, optimized geometry, precise grinding and a coordinated thin and uniform diamond coating 'on top', which does not affect either diameter or shape accuracy, is crucial. "To ensure that the high accuracy of the tools is also guaranteed after coating, we coat precision tools to the desired final dimension on request – and this can be reproduced at any time, including documentation. We also have processes specially tailored to the handling of small tools. The result is an unbeatable combination of a perfectly ground tool and a high-quality, smooth coating that ensures excellent surface quality of the milled electrode," says Manfred Weigand.

Excellent quality control is essential, especially for delicate electrodes with tolerances in the µm range. It can identify possible errors at an early stage and, if necessary, lead to the parameters being adjusted. CIMTRODE has developed a measuring and inspection system especially for mold and tool making: C-View makes it possible, for example, to check and assess wear on milling or drilling tools. It also allows an exact assessment of electrode surfaces before they are eroded. This offers enormous advantages for the user and significant improvements can be achieved in terms of quality and process reliability.

CemeCon uses C-View in combination with a laser measuring device to carry out input and output checks on precision tools. Manfred Weigand explains: "Tools, even sister tools, differ in diameter and length – even if only minimally. In order to determine the exact coating thickness for the required final dimension, it is therefore essential to measure the tools. The attachment developed by CIMTRODE with a 4K camera for the laser measuring device enables us to always measure the tools at the same measuring point

"The trend towards GRAPHITE ELECTRODES only became possible with DIAMOND COATINGS for the corresponding precision tools: Graphite is highly abrasive, which makes MACHINING extremely difficult. Without effective WEAR PROTECTION for the CARBIDE TOOLS, this is hardly economically feasible."

Daniel Gruber, Managing Director of CIMTRODE GmbH



CIMTRODE has developed a measuring and testing system specifically for mold and tool making

in a matter of seconds." CIMTRODE and CemeCon are already working together on developments to further optimize graphite machining processes to a greater extent.

WET INSTEAD OF DRY

In addition to diamond coatings, there is another development that favors the growing use of graphite – wet machining: "Until a few years ago, dry machining was considered the best possible machining method for graphite electrodes. However, the very fine dust that is produced makes this an unclean process, which is rather difficult in hygienic industries such as medical technology, for example," says Daniel Gruber. "When a mold maker who produces for precisely this sector was looking for a solution to take advantage of the massive benefits of graphite electrodes, we started a series of tests for wet machining. We were surprised by the positive results. Machining with cooling lubricants can actually be more efficient than without. The service life of the tools can be doubled in some cases. In addition, the dimensional accuracy of the electrodes was significantly increased. The result were finer, more homogeneous electrode surfaces with tight tolerances, which ultimately led to better erosion results."

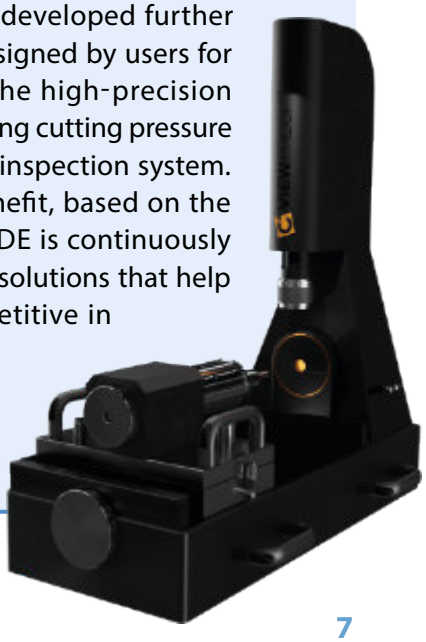
This paves the way for further precision applications, such as the production of molds for curved cell phone screens. In addition, the electrodes are washed and clean thanks to wet machining. This also has a positive effect on quality measurements and eroding with maximum precision. "Another advantage is the more flexible use of the machine. Wet machining makes graphite, copper and hard machining possible on only one milling machine. This lowers the financial hurdles for small and medium-sized companies, as there is no need to purchase another milling machine for graphite machining in addition to the eroding machine," adds Daniel Gruber.

CIMTRODE GmbH

CIMTRODE THE ELECTRODE COMPANY

CIMTRODE GmbH was founded in 1997 by Daniel Gruber and has specialized in graphite machining solutions for mold and die making right from the start. One milestone was the introduction of the "all-inclusive electrode" made of graphite. CIMTRODE's pioneering role has contributed to the widespread use of electrodes today. Thanks to many years of experience in graphite machining, CIMTRODE has developed further innovative and practical products designed by users for users. These include, for example, the high-precision SEAGULL milling cutters with cost-saving cutting pressure optimization and the C-VIEW optical inspection system. The focus is always on the user's benefit, based on the company's own experience. CIMTRODE is continuously working on first-class and innovative solutions that help to keep die and mold makers competitive in today's world.

https://www.cimtrode.com



TOOLS ARE BECOMING SMALLER AND MORE PRECISE – MICRO-MACHINING WITH HiPIMS AND DIAMOND

Dental implants, electronic components, watch movements, micro ball bearings – miniaturization is omnipresent. In order to be able to machine these tiny components reliably and economically, not only are high-precision micro-tools with special geometries required, but also coordinated coating solutions. Ultra-thin and smooth HiPIMS and diamond coatings ensure that these tools can deliver the required performance and stability in everyday machining.

In micro-machining, precision tools are only a few or even tenths of a millimeter in diameter. "With such small tools in particular, flaws in the coating – known as droplets – are fatal, as they have a much more extreme effect in these tiny dimensions than with larger tools. Consequently, uncompromising smoothness is an absolute requirement and the HiPIMS process is the key to our success," says Ramesh Agarwalla, Director at CTC Praezision Tools Private Limited, India. CTC India is an expert in micro-tools from a diameter of 0.03 mm, for example for PCB production or dental and media technology. They rely on CemeCon technology for their precision tools. Droplets cannot even occur with HiPIMS technology due to the process – in contrast to the arc process, for example. This results in extremely smooth coating solutions that also meet the low tolerances of miniature production. Post-processing is therefore not necessary.

The flawlessly smooth surfaces on the micro-tools also reduce both friction and built-up edges. At the same time, the contact time between chip and tool is reduced, the heat is dissipated with the chip and the tool is protected from the high temperatures in the machining process. In addition, HiPIMS coatings have a very hard yet tough crystal structure with extremely good adhesion. Only HiPIMS can offer this combination. It results in excellent wear resistance and therefore long tool life – even during dry and/or HSC machining.

PERFECT FOR DELICATE, COMPLEX TOOL GEOMETRIES

In the case of micro-tools, changes to the geometry caused by the coating must be avoided. This is another area where HiPIMS scores over other processes. The arc process, for example, tends to have an antenna effect. This means that excess coating thicknesses occur on sharp, free-standing objects. Narayan Singh, Works Head at CTC Praezision Tools, elaborates: "HiPIMS enables ultra-thin coatings, even below 1 µm, which ideally reproduce the filigree geometry. The homogeneous layer growth on complex tool geometries around the cutting edge ensures a homogeneous layer thickness distribution within very narrow tolerances. This means that the cutting

edges are neither affected nor unintentionally rounded."

If you want to apply extremely thin coatings to the intricate geometry of a micro-tool in an adhesive and process-reliable manner, you need low residual stresses. Christoph Schiffers, Product Manager Technology at CemeCon, explains why: "In order to maintain sharp cutting edges on small tools, the coating must follow the geometry. The low residual compressive stresses of HiPIMS coatings offer an invaluable advantage both with a 12 µm thick coating for a cutting insert and with 1 µm thin coatings for micro tools. This can be imagined as a thin sheet of metal that is bent several times over sharp edges. The bending points are where there is the greatest risk of the sheet cracking. This must not happen – not even with the coating that is applied over the cutting edge. The lower the internal stresses of the coating, the lower this risk. Our CC800® HiPIMS offers a special advantage for this: the synchronization of the HiPIMS pulses with the substrate table, where the coating grows specifically on the tools. This allows residual stresses to be controlled and significantly reduced – perfect for very thick coatings and very thin coatings on the sharp cutting edges of micro-tools."

CC800® HiPIMS: FLEXIBLE, PRODUCTIVE, CONSISTENT QUALITY

The CC800® HiPIMS guarantees consistently high and reproducible quality from batch to batch. It not only ensures a very homogeneous coating thickness distribution on the surface of a tool, but also within a coating batch – and in addition to this, different geometries can (almost) infinitely be combined in the process. Christoph Schiffers: "Precision coating for micro-tools with maximum productivity: The high uniformity and homogeneity allow dense loading of the machine. For example: 1,800 tools with a shaft diameter of 4 mm can be coated simultaneously with 3 µm within approximately 4.5 hours per batch. No other coating system works that fast!"

"In addition, the CC800® HiPIMS gives you full access to all HiPIMS parameters, allowing you to (further) develop your own coating processes. This enables a high degree of individualization and thus differentiation from the competition," adds Ramesh Agarwalla.

HIGH PRECISION WITH DIAMOND

The machining of highly abrasive high-tech materials, for example in dental and medical technology, is hardly conceivable without diamond-coated micro-tools. The high-precision multilayer CCDia® coatings are available from a coating thickness of just 3 µm. The hot filament process ensures a homogeneous coating thickness distribution with tight tolerances – even with complex, delicate geometries. All CCDia® coatings combine the very high adhesion of crystalline coatings with the smooth surface of nanocrystalline coatings. Thanks to their extreme hardness of up to 10,000 $HV_{0.05}$, they are highly wear-resistant and increase both the performance and service life of the tools. Their high thermal conductivity ensures rapid heat dissipation. Thanks to the multilayer structure, machinists also achieve significantly higher process reliability. A perfect overall package for micro-machining.

The team from CTC Praezision Tools in front in-house CC800® HiPIMS (from left): Atanu Ghosh, Somveer Kumar, Debarshi Saha, Shree Narayan Singh, Anil Kumar and Somesh Mandal

THE COMPLETE COATING PRO

The quality of coatings and thus of coated precision tools depends to a large extent on the optimum interlocking of all necessary process steps. This is why CemeCon offers all components for a complete in-house coating center from a single source – perfectly coordinated. The complete package, consisting of the coating system, substrate pre-treatment and post-treatment, covers the entire workflow. This combination guarantees the best coating results.

With the experience gained from the construction of more than 300 systems, CemeCon takes on the planning of a customized turnkey solution as a project partner. The CemeCon advantage: all components – from the coating system to pre- and post-treatment, quality control and charging – are individually adapted to customer requirements and the existing infrastructure. Even more, they are perfectly coordinated.

The experts can draw on a unique wealth of experience and comprehensive process knowledge to achieve this, as they are coating designers, plant engineers and coaters. In one of the world's largest coating centers for cutting tools in Würselen, Germany, CemeCon finishes up to 80,000 precision tools with high-quality premium coatings every day. A turnkey solution seamlessly integrates this extensive wealth of experience as well as the proven CemeCon coating materials into the customer's production.

EVERYTHING YOU NEED FOR YOUR OWN IN-HOUSE COATING OF YOUR PRECISION TOOLS IN ONE PLACE:

webcatalog.cemecon.com

PRE-TREATMENT

Incoming inspection → Pre-batching → Cleaning →

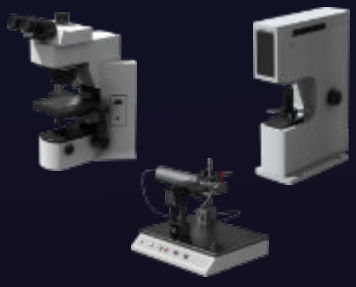



COATING

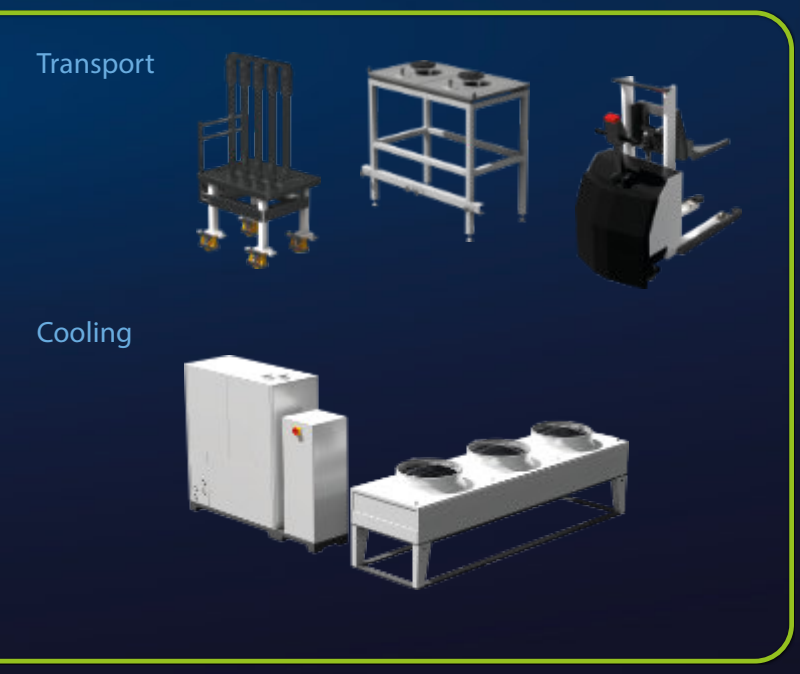
CC800® HiPIMS –
The heart of a coating line - with all proven coating material recipes

POST-TREATMENT

Quality control → Finishing




CESS FROM A SINGLE SOURCE



COATING

At the heart of a turnkey solution is the CC800® HiPIMS. With coating rates of up to 2 µm/h, coating thicknesses from 1 µm to currently 12 µm and capacities of up to 1,800 shank tools or 5,000 cutting inserts, it is the fastest, most flexible and most economical coating system on the market. It is the perfect platform for developing customer-specific processes.

BLASTING

Blasting systems optimally prepare the substrate – more precisely the tool surface and cutting edges – for coating. They remove cobalt deposits, burrs and grinding burn from the tools.

CLEANING

The cleaning systems ensure that the tools are cleaned gently. Before coating, they create a clean basis for optimum adhesion. In post-treatment, residues from any finish can be completely removed.

QUALITY CONTROL

Good output quality is the basis for good performance: this is why CemeCon offers numerous suitable test devices for customized quality assurance.

COOLING

Cooling systems dissipate the heat generated during coating and thus ensure the necessary process reliability. CemeCon offers reliable, compact and energy-saving cooling systems for every system size and coating technology.

BATCHING

With years of practical experience from its own coating service, CemeCon has developed perfectly matched holder systems for different types of tools, which ensure optimum utilization of the systems in pre-treatment, coating and post-treatment.

FINISH

With coordinated finishing processes, the tool surface and cutting edges can be optimally post-processed.

STEELCON® RECIPE FOR SUCCESS

Silicon (silicon dioxide) is literally a dime a dozen. The earth's crust consists of about 25.8 percent silicon by mass. This makes silicon the second most common chemical element after oxygen. It is mainly found in silicate minerals or as pure silicon dioxide – for example as quartz or even sand. But what does this have to do with machining? Coatings containing silicon are the answer to materials that are difficult to machine, such as hardened and stainless steels or titanium.

The harder the material, the higher the temperatures in the machining process usually are. This is why hard and temperature-stable coatings are required here. Silicon as an oxide is extremely hard, thermally very stable and insulates well against heat. This makes the element an essential component in the recipe for success of a coating material that is used for machining demanding materials – such as the HiPIMS coating material SteelCon®.

SteelCon® was developed by CemeCon for machining hardened steels with more than 50 HRC. These materials are very hard, but can also have a certain toughness. They often contain alloy components that ensure high corrosion resistance. These make machining tasks even more difficult. With a very high silicon content, SteelCon® is ideally suited to the demanding operating conditions in hard machining. "And it can do even more, because our two-layer HiPIMS coating material is a true all-rounder: SteelCon® also delivers top performance in other difficult-to-machine materials, such as stainless steels, nickel-based alloys, titanium, but also 'normal' steels. This has been proven by numerous practical tests and is underpinned by our customers' catalog products," says Manfred Weigand, Product Manager Round Tools at CemeCon. He is pleased with the excellent results in various applications.

SteelCon®

for hard machining, stainless steels, titanium and titanium alloys

Properties:
very wear-resistant, homogeneous wear behavior, high thermal stability, excellent adhesion, extremely smooth

composition:
TiAlSiN based, high Silicon

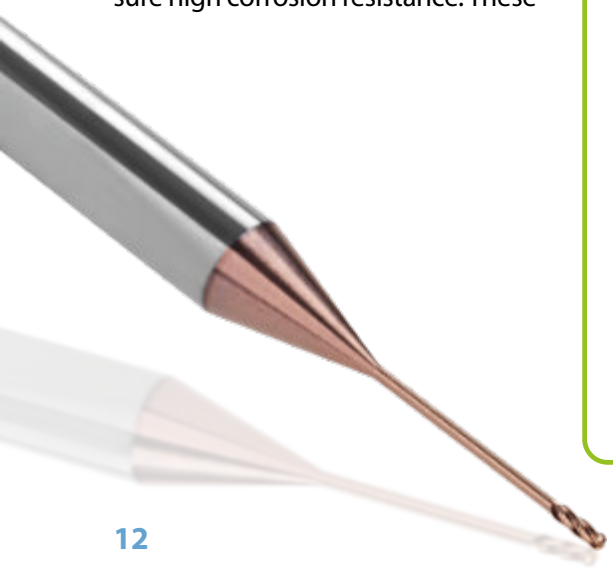
max. operating temperature:
1.100 °C

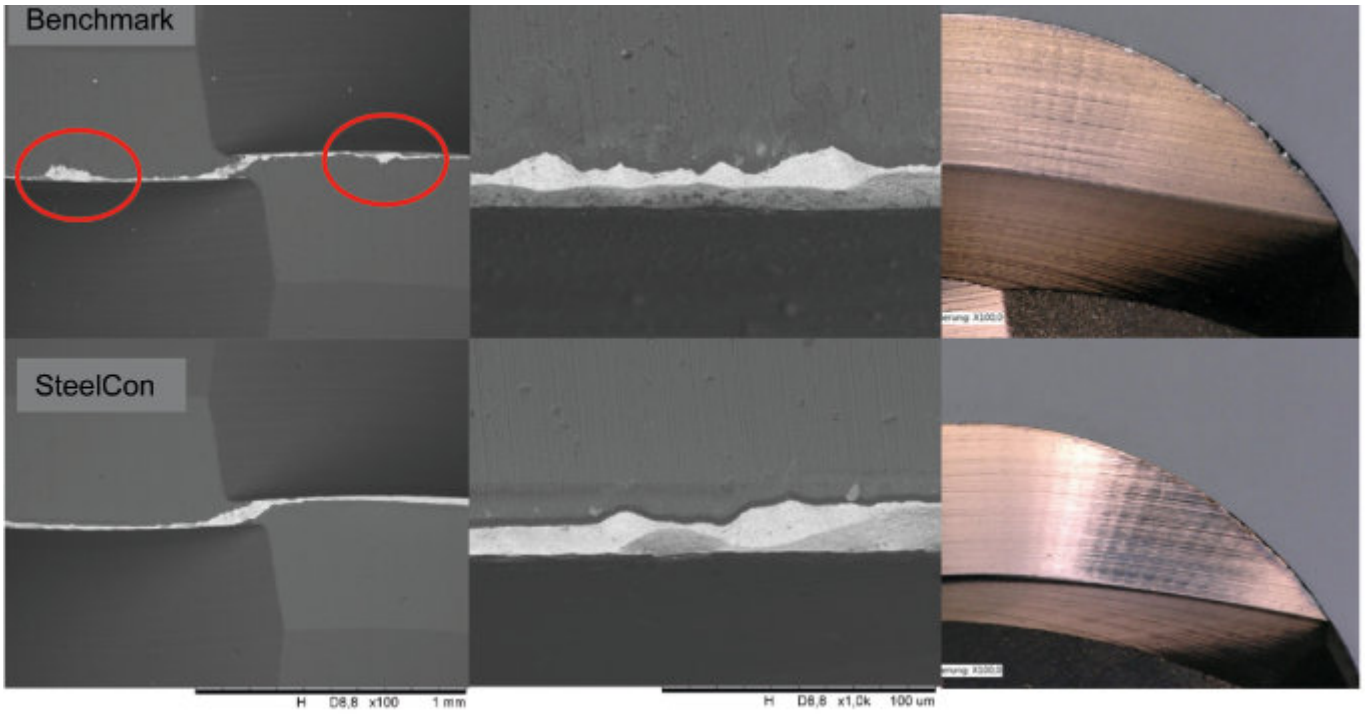
Color:
Red gold

Coating thickness:
1, 5 µm and 3 µm

IN COMBINATION UNBEATABLE

SteelCon® is an excellent insulator against heat and hardly lets any heat into the tool, instead dissipating it via the chip. This is particularly advantageous for materials that are themselves very poor heat conduc-





When milling hardened, alloyed stainless steel (1.2379) with a hardness of 62 HRC, the SteelCon®-coated tools exhibit significantly less wear than the Benchmark

tors, such as stainless steel or titanium. Without SteelCon®, the high temperatures that inevitably arise when machining hard materials would embrittle the carbide and thus damage the tool.

Thanks to the HiPIMS process, no imperfections in the form of droplets can form, making SteelCon® extremely smooth. This means that nothing stands in the way of optimum chip and heat removal. The tool can dissipate the heat in the chip, increasing process stability. Excellent surface finishes are achieved, so that the users can often save on subsequent work – sometimes even polishing their workpieces is no longer necessary.

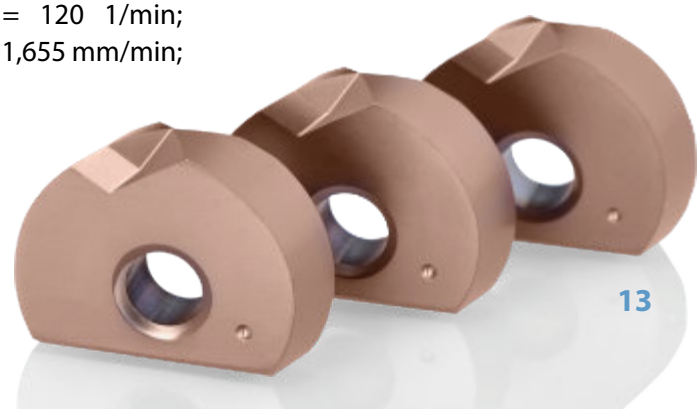
Manfred Weigand: "HiPIMS has another unbeatable advantage. This technology enables the adjustment of residual stresses that can be perfectly adapted to the coating, tool geometry and application. This has a direct and positive effect on adhesion and wear resistance."

SteelCon® is available for round tools and now also for cutting inserts in series production.

EXCELLENT RESULTS IN THE PRACTICAL TEST

One example shows the superiority of precision tools with SteelCon® coatings: For this, a block of hardened, alloyed stainless steel (1.2379) with a hardness of 62 HRC was filed dry with ball nose end mills (d = 6 mm) (v_c = 120 1/min; n = 6,366 1/min; v_f = 1,655 mm/min; z_f = 0.13; a_p, a_e = 0.1 mm). After three passes (183 m // 5h:33min), the SteelCon®-coated milling cutter shows significantly fewer wear characteristics compared to the competitor coating (see pictures).

"In order for SteelCon® to achieve its excellent results, we made numerous adjustments: in addition to the coating material, these include the coating thickness, tolerances, pretreatment and finishing. The process steps are then sensibly combined and adapted to the tool during engineering. The result is a customized coating specification that is perfectly tailored to the application," adds Manfred Weigand.



THE RIGHT CHOICE FOR A PRECISION TOOL

Complex products and modern high-tech materials are placing ever greater demands on precision tools. Carbide tools have numerous advantages over HSS tools: They are harder, more wear-resistant, more heat-resistant and, with a few exceptions, have a longer service life. They enable high-precision machining and higher cutting speeds. The prerequisite for this is the perfect combination of substrate, geometry and coating. The carbide as the basis is of particular importance here.

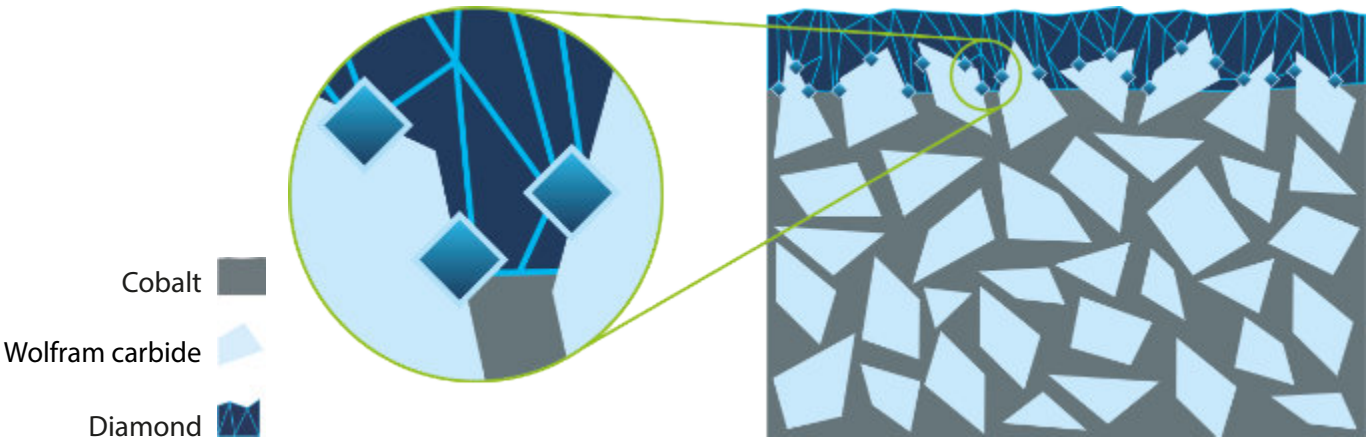
"Carbide has extremely good properties for cutting tools: such as hardness, compressive strength, impact resistance, flexural strength, corrosion resistance and more. Over the past 30 years in particular, enormous progress has been made in manufacturing, and the relationship between hardness and toughness has been significantly optimized. Today, carbide tools have replaced HSS tools in almost all areas," describes Bruno Süess, former director and current member of the supervisory board of EXTRAMET AG, board member of the Swiss Powder Metallurgy Association as well as expert in carbides and their production and advantages.

Quality right from the start: Carbide production at EXTRAMET

IT ALL DEPENDS ON THE COMPOSITION

Carbide for cutting tools consists mainly of tungsten carbide (WC) as the hard material and a binder metal, usually cobalt (Co). The tungsten carbide provides the hardness and the cobalt provides the toughness. This combination enables the best physical and mechanical properties to be achieved. The exact composition and the addition of other alloy components are very flexible and depend on the requirements of the application.

The hardness of a carbide is primarily regulated by the WC grain size: the



When coating with diamond, the proportion of cobalt in the carbide is of particular importance. It must neither be too large nor too small. CemeCon is happy to advise tool manufacturers on the selection of a suitable carbide on request

finer the grain, the harder the carbide. In machining, carbides with ultra-fine grain (0.2 – 0.5 µm) and micro grain (0.5 – 0.8 µm) are now standard. Nano grain (<0.2 µm) has not yet been able to establish itself and is only used for very special purposes. Production is far too costly compared to the benefits that the extremely small grains bring in comparison.

"But hardness isn't everything: The wear resistance also depends on how well the hard tungsten carbide grains are embedded in the cobalt binder metal, how well they are wetted and how well they have bonded there. If the cobalt is not well distributed and the WC grains are therefore directly adjacent to each other, they simply detach from the matrix, resulting in increased wear," says Bruno Süess. "To achieve high wear resistance, you have to find the perfect balance between grains and binder so that the tungsten carbide is still well bonded but the cobalt content is not too high. This ratio can be easily controlled today, so that many high-performance carbide grades are now available on the market."

DIAMOND COATINGS FOR CARBIDE TOOLS

The composition of a carbide is decisive for its coatability with diamond coatings. "In the past, the adhesion of the diamond coating to the carbide was not as good as it is today. That's why we – CemeCon and EXTRAMET – worked closely together back in the 1990s to adapt the composition of the carbide and thus improve adhesion. For example, we developed a special carbide grade for diamond coating with selected alloy components. In a trilateral working group, particularly with regard to the requirements of the aviation industry, we were able to achieve great progress for diamond tools together with the Technical University of Hamburg-Harburg (TUHH)," recalls Bruno Süess.

For good coatability, it is important that the grain is not too fine and that the carbide does not contain too much cobalt. "My personal favorite for diamond coating is a micro-grain carbide with a WC grain size of 0.8 to 0.9 µm and 6 percent cobalt," adds Süess.

CemeCon operates the world's largest diamond coating center in Würselen

The cobalt content is particularly important when it comes to coating with diamond, as the cobalt is dissolved from the surface of the carbide during the coating process. Manfred Weigand, Product Manager Round Tools at CemeCon, explains: "If the proportion is too small and too much cobalt is dissolved, the WC grains no longer hold together. The carbide becomes too brittle and good adhesion is no longer possible. If the proportion is too large, too much cobalt remains, which reacts with the carbon during the coating process. This results in a graphitic phase (sp^2) instead of the hard diamond coating (sp^3)."

For this reason, CemeCon carries out appropriate suitability tests in which the carbide is tested for its coatability.

ONLY HIGH-QUALITY CARBIDE ENSURES PREMIUM COATINGS

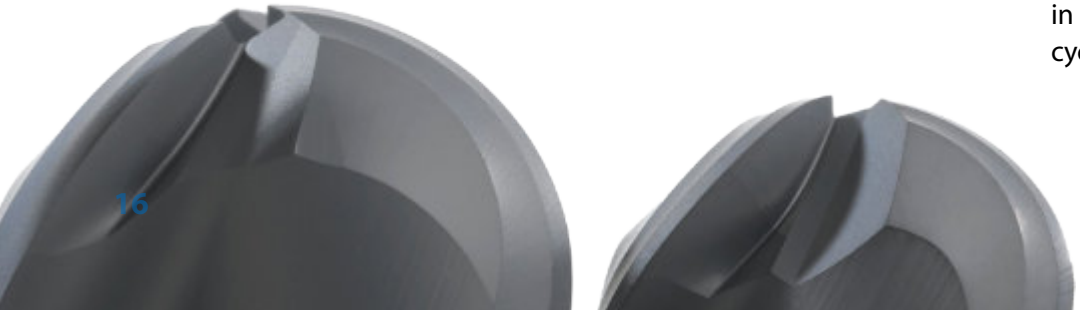
The homogeneity and therefore the quality of a carbide has a significant influence on the coating result and therefore also on the performance of the precision tool. High-quality carbides achieve both good adhesion and a uniformly coated surface. "Purity in the carbide manufacturing process and consistently high quality are inextricably linked. This starts with the mixing of the powder. It should be exposed to an oxygen atmosphere for as short a time as possible to prevent oxidation. It is therefore important to process the powder quickly, as the material oxidizes if it is stored for a long time. However, as soon as the powder is pressed and the green compact is pre-sintered, not much more happens in this respect," explains Bruno Süess.

Another factor for the quality – even within a batch – is the sintering process. If some of the green compacts are exposed to a higher carbon concentration than others, the carbon content varies in the carbide blanks and ultimately also in the ground tool. These differences can lead to poor and/or uneven adhesion of the diamond coating.

ALMOST NO DIFFERENCE IN QUALITY COMPARED TO RECYCLED CARBIDE

Resource conservation, environmental protection and the CO_2 balance are becoming increasingly important in carbide production, as in all industries. The recycling of worn carbide tools is also becoming increasingly important in view of the mining areas and the conditions prevailing there. Processes have made great progress in this area, with the result that the proportion of recycled carbide has risen steadily in recent years. Using chemical processes, all components of the carbide can be separated into their constituent parts – tungsten carbide, cobalt, etc. – and transferred back into the raw products – with less energy input.

"Many carbide manufacturers, including EXTRAMET, now use a mixture of new and recycled material. There are no longer any differences in quality between high-quality recyclate and new powder," says Bruno



"CemeCon and EXTRAMET have been WORKING CLOSELY TOGETHER back in the 1990s to adapt the composition of the CARBIDE and thus improve ADHESION.This resulted, for example, in a special carbide grade for DIAMOND COATING with selected alloy components."

Bruno Süess, former director
and current member of the supervisory board of EXTRAMET AG

Süess. Hard metal made purely from recycled material has hardly been available on the market to date, but corresponding developments have already been initiated. "At CemeCon, we have already tested tools made from 100 percent recyclate for their suitability for diamond coating. We have also tested the concentricity before and after coating. We were able to give the green light after all the tests," adds Manfred Weigand.

MAJOR CHALLENGES FOR THE FUTURE

In addition to the declining demand for carbide due to the switch to alternative drive systems in the automotive industry, the effects of the REACH Regulation (European Chemicals Regulation on the Registration, Evaluation, Authorization and Restriction of Chemicals) are certainly among the major challenges facing the carbide industry. REACH has also placed cobalt (Co) and nickel (Ni) on the red list. Manufacturers are therefore forced to minimize or completely replace cobalt and nickel in the composition of hard metals without changing their positive properties. Research has already achieved encouraging results in recent years, but the new carbides do not yet meet the desired mechanical requirements, especially when it comes to solutions for cutting tools.

EXTRAMET AG

EXTRAMET
WE LIVE FOR CHALLENGES

Precise, durable and sustainable carbide solutions for the high-tech industry are EXTRAMET's core competence. The high-quality carbide tool blanks are the basis for the production of high-precision rotary cutting tools for demanding applications. Since its foundation in 1980 in Plaffeien, Fribourg (Switzerland), EXTRAMET has developed from an original three-man operation into a broadly diversified and internationally active company with over 200 employees worldwide. In the production of extruded carbide, the experts focus on innovation, precision and high technology and offer customized solutions for individual requirements. Maximum precision combined with top-quality carbide makes the family-run company the ideal partner for the highest demands in high-tech industries. EXTRAMET carbide is used in the aerospace and automotive industries, dental and medical technology, precision and micromechanics, as well as in food and packaging technology.

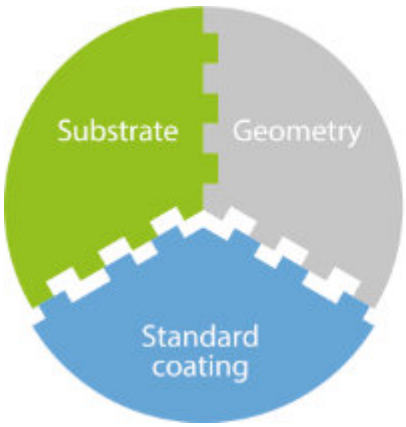
https://www.extramet.ch

THE PROCESS CHAIN OF TOOL MANUFACTURE

The increasing demands of the machining markets present manufacturers of precision tools with major challenges. In order to be successful in promising future markets such as tool and mold making, medical technology, electromobility and the 3C industry and to stand out from the competition, the production of highly accurate precision tools with specific properties is required. Only those who have the entire product development process in the precision tool sector in mind right from the start will win the head-to-head race. CemeCon has represented this holistic approach for years. As a supporter of the GRINDER OF THE YEAR 2024 competition, the experts, together with other renowned technology providers, want to draw attention to the entire process chain and at the same time set an example against the shortage of skilled workers.

If you want to machine high-performance materials precisely and economically, you need application-specific tools and processes. Standard solutions have narrow limits here. When manufacturing customized high-end solutions, there are many factors that determine the quality and accuracy of the end product: from the choice of carbide to the grinding machine and the coating. Only when all components are already in focus during the design phase and interlock perfectly can a cutting tool be created that meets all requirements. This makes the difference on the chip and en-

Coating is an essential component in the process chain of tool manufacturing



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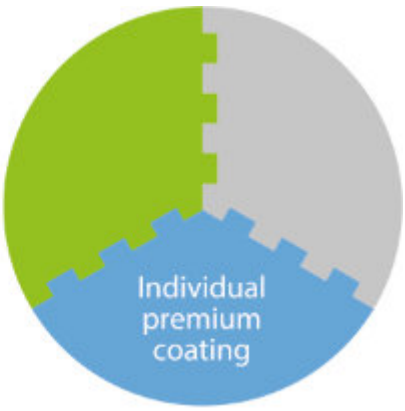


Standard solutions have narrow limits. If all components – substrate, geometry and coating – are perfectly matched, the result is an outstanding precision tool with which machinists can achieve top performance

sures shorter cycle times, high process reliability, better machining results and lower production costs.

FOR UNCOMPROMISING QUALITY

CemeCon has been cooperating with ANCA CNC Machines, a leading manufacturer of CNC grinding machines, for some time now in order to keep an eye on the entire manufacturing process of a premium tool (see back cover of FACTS) and to be able to coordinate the interaction of the various process steps even better. At the GRINDER OF THE YEAR 2024 young talent competition at GrindingHub in Stuttgart, the two partners are working together with other innovative technology suppliers along the entire grinding process chain. They all stand for the same values on the market: they pursue their premium standards to help their customers succeed.

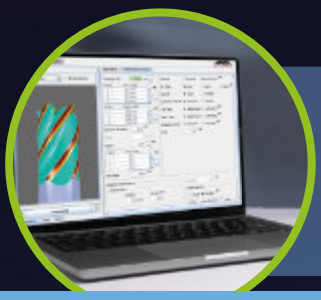
"On the one hand, the GRINDER OF THE YEAR 2024 competition is a special opportunity for up-and-coming talents to showcase their grinding skills, and on the other, it emphasizes the importance of the individual process steps in tool manufacturing – from carbide selection to the grinding process and coating. We are proud to support the passion for precision and progress in the industry and look forward to presenting our expertise in this high-profile context," says Melanie Heeg, Product Management & Marketing at CemeCon.

PERFECTLY COORDINATED HIGH-END SOLUTIONS

CemeCon pursues a holistic approach: If required, the experts advise tool manufacturers from the outset on the selection of the substrate, the design of the geometry and, of course, the construction of the appropriate coating. This is the only way to create an outstanding precision tool with which machinists can achieve top performance.

In joint engineering in close cooperation with the tool manufacturer and, in the best case, the user, the experts at CemeCon tailor the premium coating precisely to the requirements. The more the specialists know about the application and are involved in tool development, the better they can design the coating. In addition to the coating material, these include coating thickness, tolerance, pre-treatment, finishing and much more. "To adapt the coating perfectly to the requirements and the tool, the process steps are combined sensibly and the parameters are precisely coordinated. In this way, the coating is combined with the substrate and the geometry to create an optimum machining solution for the respective application," says Manfred Weigand, Product Manager Round Tools at CemeCon. "HiPIMS offers another special feature: The process enables the combination of the chemical composition of a coating material and the unique physical properties that are only possible in this form with HiPIMS coating technology. This enables manufacturers to secure unique selling points."

TOOL MANUFACTURING PROCESS



TOOL DESIGN

CARBIDE SELECTION

TOOL GRINDING PROCESS

- Clamping device
- Grinding wheel
- Dressing
- Cooling lubricant
- Cooling lubricant ultrafine filtration

TOOL GRINDING

TOOL MEASUREMENT

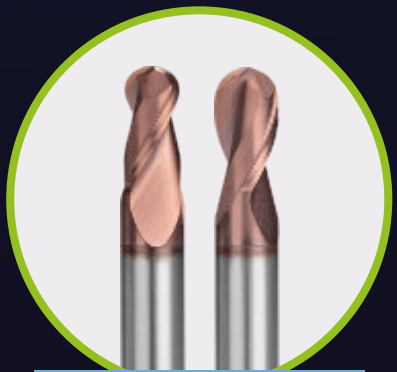
TOOL COATING

COATING PROCESS

- Pre-treatment
- Coating materials
- Post-treatment

(More on this page 10/11)

QUALITY CONTROL



PRECISION TOOL

GEMECON The Tool Coating

GRINDER OF THE YEAR 2024