CEMECON The Tool Coating

CUSTOMER MAGAZINE
FOR COATING TECHNOLOGY

FACTS

No. 43 September 2016

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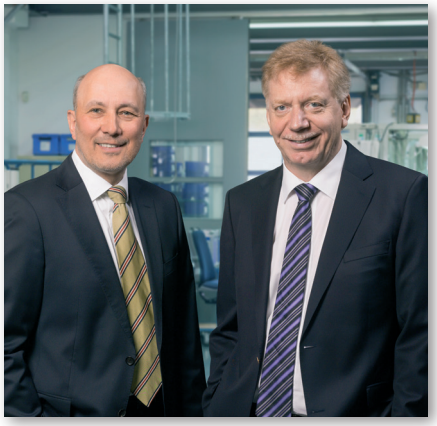
FOR 30 YEARS – FUTURE MADE BY CEMECON



Dr. Oliver Lemmer (left) and
Dr. Toni Leyendecker,
the executive board of CemeCon AG

Thirty years ago, CemeCon was founded with the idea of applying TiAlN (titanium aluminum nitride) coatings to cutting tools. Today, about three-fourths of all PVD tool coatings applied worldwide on a wide variety of tools are titanium aluminum nitride-based. We became a trendsetter when we were granted the patent for TiAlN.

The next innovation came just three years later – diamond coatings! As is often the case when innovations are concerned, areas of application and markets take time to appear. Who could have foreseen the importance of using fiber materials in the aircraft and automotive industry? Today we are the undisputed technology leader in this sector.

Although we at CemeCon cannot predict the future, we proved back then, and we are still proving it today, that we have a very good feel for future needs, including options in sputter technology. CemeCon is still the only company in the world that consistently relies on this process for the manufacture of PVD coatings for cutting tools. Similar coatings using other technologies would perhaps be easier to manufacture, but they would definitely not be better! The market has proven us to be right.

Specialists predict today that the future of PVD coatings lies in HiPIMS (High Power Impulse Magnetron Sputtering) technology, further development of sputtering. The new HiPIMS system will be introduced at the AMB in Stuttgart, presented by CemeCon on the occasion of its 30th anniversary. It opens up tremendous opportunities with versatile coating construction. We are also presenting a new generation of pure HiPIMS coatings. These coatings feature the highest smoothness, hardness and toughness. Read more about this on page 5. Visitors who come to the **AMB,** Hall 2, Booth B23, the **IMTS**, West Building, Booth W-1716, as well as the **JIMTOF**, East Hall 7, Booth E7075, will be able to take a look at the potential for our latest innovations to make their tools even more effective.

Looking back at the last 30 years, it is not presumptuous for us to say we have helped develop the future, several times over, in fact. A kind thank you to everyone who has made it possible for us to create these innovations and who wish to continue with us into the future on this path to success!

PREPARE TO BE INSPIRED!

Yours sincerely,

Dr. Toni Leyendecker Dr. Oliver Lemmer

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"Unconditional QUALITY in machining of CFRP is paramount in the construction of our PREMIUM AIRCRAFT. With CCDia®AeroSpeed® we achieve the highest PROCESS RELIABILITY and performance. Thank you! I wish you continued SUCCESS and the ABILITY TO CONTINUE INNOVATING for the next 30 years!"

Jan Stuhrmann,
manufacturing technology development, drilling expert for Airbus

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HiPIMS: AN INCREASE IN PREMIUM

The new CC800® HiPIMS opens a new chapter in the coating of cutting tools. It combines the highest productivity, maximum flexiblity and the superior quality of pure HiPIMS (High Power Impulse Magnetron Sputtering) coatings.

CemeCon has consistently relied on sputter technology for the manufacture of high performance coatings for 30 years. Our decades of experience were and continue to be the best starting point for the development of the new CC800® HiPIMS. This innovative coating system makes it possible to deposit pure HiPIMS coatings in short cycle time. Lot sizes are getting smaller and smaller and the market continuously sets higher demands with regard to the quality of dedicated coatings. HiPIMS fully embraces this trend!

The CC800® HiPIMS can atomize virtually any material. This means that HiPIMS is the most flexible method of producing coatings for cutting tools. But it's not just this flexibility that impresses. It also guarantees the highest productivity, with its extremely high deposition speed.

The new CC800® HiPIMS coating systems deposit pure HiPIMS coatings at a speed of up to 2 µm/hr. Such a door-to-door batch time of slightly more than four hours achieved for both round shank tools and indexable inserts are unrivalled. A substrate table with six satellites can be loaded into the system, i.e. up to 1,800 shank tools or up to 5,000 indexable inserts. The machine's high deposition rate means that up to 9,000 round shank tools or up to 20,000 indexable inserts can be coated per day.

The system combines the latest technology with an attractive and functional design. The outstanding intuitive touch operation supports the efficient and powerful control. Pneumatic drives for the chamber doors and the new design of the cover shields to protect the chamber showcase the pursuit of perfection in the development of the CC800® HiPIMS. But it doesn't just look good. The latest computer technology and the built-in power failure protection mean that the CC800® HiPIMS is a very robust system.

The CC800® HiPIMS coats up to 9,000 round shank tools or 20,000 indexable inserts per day.

"The many years of COLLABORATION between CemeCon and Horn has led to significant TECHNOLOGICAL LEAPS in the coating sector. It is great and very beneficial to have a TECHNOLOGY PARTNER that you can shape the FUTURE with. I offer my sincere congratulations to the company on the occasion of its 30TH ANNIVERSARY and I am looking forward to our NEXT JOINT PROJECTS and challenges. Best wishes!"

Lothar Horn,
CEO of Paul Horn GmbH

WORLD INNOVATION: PURE HiPIMS COATING MATERIALS

THE HIGH-PERFORMANCE HiPIMS DUO

FerroCon® and InoCon®, the new pure HiPIMS coating materials, are the outstanding result of the CC800® HiPIMS (see page 4). This new generation of coatings offers unsurpassed smoothness, hardness/toughness, density and adhesion.

"With the CC800® HiPIMS, we have achieved the next breakthrough innovation in the coating sector. For the first time, thanks to this technical advancement, pure HiPIMS coatings can be deposited economically. They have demonstrated their superior quality in the first machining tests, (see page 14)" raves Dr. Stephan Bolz, PVD Process Development Coating Technology.

FERROCON

INOCON

It is no wonder that CemeCon is way ahead of the pack with this. HiPIMS technology represents the next evolutionary step in the development of the sputtering process, and as a premium coating producer, CemeCon is the only company in the world that has consistently focused

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TOOL MANUFACTURERS can expect significant PERFORMANCE IMPROVEMENTS in machining – STEEL with FerroCon® and STAINLESS STEEL with InoCon®.

CONTINUED FROM PAGE 5

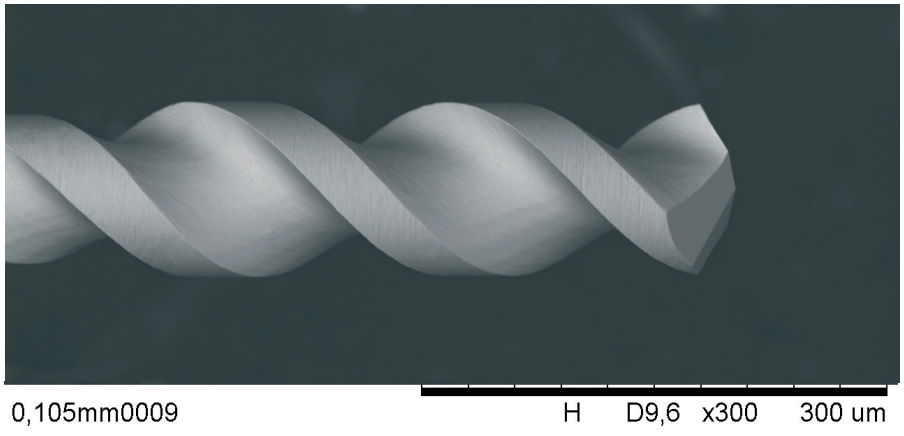
on sputtering technology for cutting tools – for 30 years. CemeCon has concentrated this incomparable wealth of experience on the development of the innovative CC800® HiPIMS system and new coating materials, thereby achieving something that is amazing.

SIMPLY HiPIMS

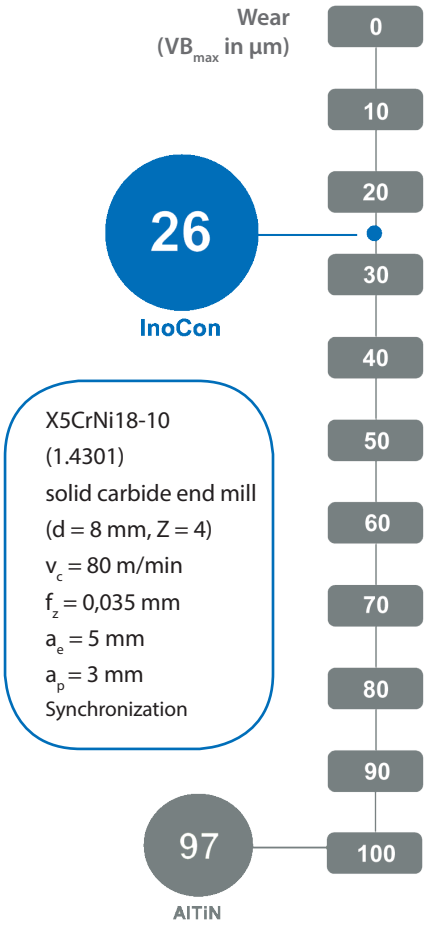
In sputtering, materials are transferred from solid to plasma without any molten phase in between. As a result, sputter coatings are 100% free of any droplets and very smooth. Moreover, almost any target composition can be sputtered. With its high metal ionisation, HiPIMS coatings are denser and have the best adhesion, surpassing those of arc coatings.

Dr. Stephan Bolz says: "If you are thinking, 'I'm already familiar with that!', you are not entirely wrong. However, so-called HiPIMS coatings have thus far always been deposited with a hybrid technology composed of DC and HiPIMS. Our new CC800® HiPIMS produces pure HiPIMS coating materials that surpass anything available until now."

They are free of droplets and extremely smooth, show low intrinsic stress, exceptionally hard and wear-resistant, and have incomparable coating adhesion. These superior qualities, when compared to conventional PVD coatings, offer better tool surfaces and higher cutting data, to guarantee higher



The view under the scanning electron microscope shows how smooth the pure HiPIMS coatings are.



material cutting data and longer service life. Tool manufacturers can expect significant increases in performance in machining.

This new technology also opens up enormous opportunities in coating design, providing maximum flexibility. "Initially, we are introducing two pure HiPIMS coating materials – FerroCon® and InoCon®. These names are not just random word constructions, but should draw the user's attention to the range of applications each coating offers. Dedicated coating solutions that are precisely tailored to customer needs is our passion," explains Dr. Stephan Bolz.

The AlTiN-based, pure HiPIMS coating FerroCon® was specifically developed for machining steel (**Ferro** = ferrous material). InoCon® a copper-colored pure HiPIMS coating achieves outstanding results in the machining of stainless steel since it is alloyed with silicon. The prefix "**Ino**" is derived from a synonym for stainless steel, "Inox" (in French: inoxydable = stainless). The chart shows significantly less wear in machining austenitic chrome-nickel-steel by using InoCon® compared to AlTiN. The next pure HiPIMS coating for processing non-ferrous metals is already under development.

CemeCon offers the new coating materials in various coating thicknesses. These are between 1,5 µm and 6 µm, depending on the coating type and tool geometry.

CemeCon was able to draw on its 30 years of experience in sputter technology in the development of the pure HiPIMS coatings.

THREE CLASSES OF PREMIUM COATING

With these new developments, CemeCon now offers tool manufacturers three classes of coating materials: high-quality sputter coatings, such as HYPERLOX®, unique diamond coatings, such as CCDia®AeroSpeed®, and the new pure HiPIMS coatings. As with the pure HiPIMS coatings, users can also easily figure out the origins of the other coating materials by their names, and determine what the fields of application for them are. HARDLOX, for example, is for hardened steel machining, CCDia®CarbonSpeed is for graphite machining and CCDia®AeroSpeed® is for the processing of CFRP in aircraft manufacturing.

You can find detailed information about the new HiPIMS technology here: www.cemecon.de/hipims


THE coating system
CC800 HiPIMS

The new CC800® HiPIMS opens a new chapter in the COATING of CUTTING TOOLS!


CC800 HiPIMS
Coating - Process running
58 %
Proceed

30 years

Future made by CemeCon

The CC800® HiPIMS combines maximum FLEXIBILITY, the highest PRODUCTIVITY and superior QUALITY.

THE coating system

CC800 HiPIMS

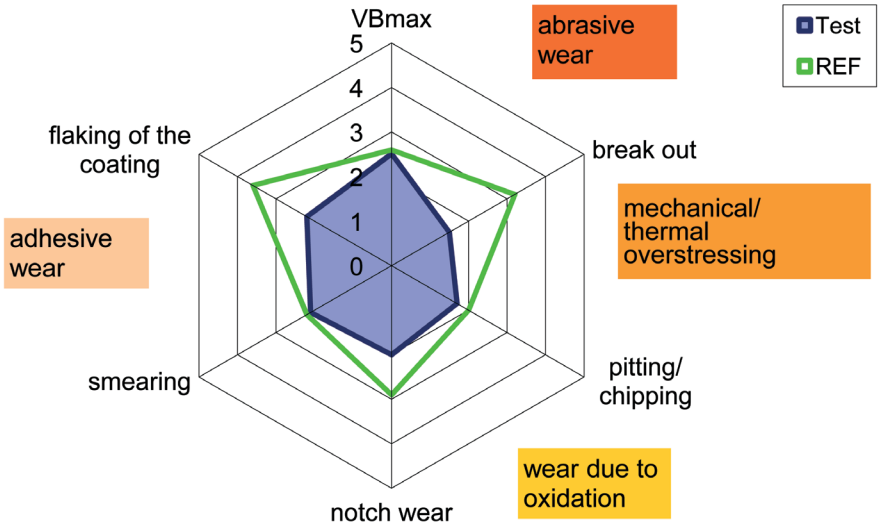
MACHINING TESTS CONFIRM PERFORMANCE

FH AACHEN
UNIVERSITY OF APPLIED SCIENCES

CemeCon opens a new chapter in the future of tool coating with the new HiPIMS system and pure HiPIMS coating materials. The close collaboration with Aachen University of Applied Sciences (FH Aachen) has made a significant contribution and supports the performance of the newly developed coatings in machining tests.

In daily production operation, we depend on extended tool life and stable processes. Therefore, coating developers must guarantee the production launch of the coatings. To demonstrate the performance efficiency of the new coatings, they must prove themselves under real-life conditions. CemeCon has long been supported in this through machining tests at the machining laboratory of FH Aachen, including in the development of the new HiPIMS system and the new HiPIMS coating materials (see page 5).

Wear form on the flank face (average)



42CrMo4 (approx. 770 N/mm²)		1 = not available
Cutting inserts (milling cutter)		2 = barely/slightly available
v_c = 180 m/min	f_z = 0,15 mm/Z	3 = available
n = 1150 U/min	a_e = 26 mm	4 = very readily available
v_f = 690 mm/min	a_p = 2 mm	5 = excessively available

The modern machining centers of the central workshop of the Department of Mechanical Engineering and Mechatronics are ideal for testing the new tool coatings in milling, drilling or turning. "The machining tests take place at the University of Applied Sciences. The tools are returned to us for evaluation and wear assessment. Of course the proximity to each other's facilities is an unbeatable advantage," said Dr. Werner Kölker, Head of Research and Development at CemeCon.

In the development of the new HiPIMS coatings, the results in the machining laboratory also provided exactly the feedback that CemeCon needed to initiate the next round of development practically and quickly. "The close collaboration, with no bureaucracy, with the machining laboratory at FH Aachen is an extremely valuable advantage in this respect. Pushing the boundaries in coated tools is necessary for the development of new coatings and has confirmed to us the high performance capacity of the new HiPIMS coatings," adds Dr. Werner Kölker.

DIAMONDS MADE BY FRAISA

Around 20 years ago, Fraisa started coating tools in-house with its own coating system. Today, the Swiss company operates five plants at three different sites with a large number of coating concepts that were partially developed in-house. The requirement for this successful in-house coating work is, in addition to proven and reliable technology, continuous, professional and guaranteed support from the system manufacturer.

Dr. Hans Rechberger, Head of Material and Surface Technology for Fraisa.

An important benefit of in-house coating is customized product design with optimization of coatings based on individual needs. "In this way, we can respond in a significantly differentiated manner to the specific characteristics of various types of tools. It is actually the cutting edges and surface preparation work before and/or after the coating that leads to more significant customization of our high-performance tools," says Dr. Hans Rechberger, Head of Material and Surface Technology at Fraisa.

For more than a year, Fraisa has been running a multi-chamber diamond coating system from CemeCon at its Hungarian Sarospatak facility. For this purpose, an ultra-modern coating infrastructure with complete analysis and measurement technology was established. "The partially chemical-based pretreatment procedures on the tool in the CVD diamond process constitute a slightly higher hurdle for a more 'mechanically' aligned operation like Fraisa. But in this case, we also managed to produce our own coatings in a very short time, thanks to the excellent support from the system and technology supplier CemeCon and its well-trained staff. Today, a large team of engineers and technicians works on the finishing of high profile tools," says Dr. Hans Rechberger.

CUSTOMIZED COATING THICKNESS

Diamond coatings ensure a high wear resistance for tools, especially when machining graphite and modern composites, such as CFRP. The rule of thumb: the thicker the coating, the longer the tool life. Coating thicknesses up to 10 µm and more are possible.

CONTINUED ON PAGE 16

Workplaces in the diamond process are designed such that the various operations intermesh optimally. (Photo: Fraisa)

The management of Fraisa and authority representatives standing in front of the CC800® DIA at the inauguration of the new coating center at Sarospatak in Hungary. (Photo: Fraisa)

CONTINUED FROM PAGE 15

Besides limiting the costs, the cutting edge radius limits the maximum. The radius increases more or less linearly with the coating thickness. Dr. Hans Rechberger has this to say in this regard: "For larger milling tools, this is often tolerable, but definitely not for micro tools. A large radius there would lead to severe tool wear and could possibly lead to increased cutting forces and tool breakage. Therefore, it is important to find a compromise between the maximum permitted cutting edge radius and the greatest possible coating thickness. For maximum endurance with no influence on the functional efficiency, our tolerances are very narrow."

In-house coating with the CC800® DIA system from CemeCon provides great advantages for us: The diamond coating thickness is particularly difficult to measure, especially on the cutting edge, and must therefore be controlled by precise process control. Fraisa measures every individual precision tool and even does subsequent coating, if necessary, to attain the desired coating thickness. This is relatively simple with a new tool, but with a worn out or reground tool, it does not work. This is because the uncoated carbide surface of the tool must be specially pretreated in order to grow the diamond crystals.

THE RIGHT COMBINATION

The selection of the right carbide is of prime importance. The thermal expansion coefficients of diamond and carbide differ from each other. This result in intrinsic stress coating during the cooling of the process temperature. To ensure sufficient adhesion of the coating, the surface of the tools must be microscopically roughened, for a better mechanical micro anchoring of the coating. This is a major technical challenge in the precision sector, with diameter tolerances of only a few microns and radii of cutting edges that should not be additionally rounded.

"We feel it is extremely important to design the tools specifically for the application. The key question here is which diamond tool type is best suited for each application. This way, we can always offer an optimized, tailored 'package' to the customer. With the in-house diamond coating line from CemeCon, Fraisa has become the jewel among tool manufacturers," said Dr. Hans Rechberger.

THE FRAISA GROUP IN DETAIL

Fraisa SA started its production facility in Bellach (Solothurn), Switzerland, in 1934, as a manufacturer of cutting tools for the watch industry. The family-run company now has its own subsidiaries in seven countries. Its core business includes carbide end mills and drills, taps and indexable inserts. In addition to uncompromising quality standards, the cornerstone of Fraisa's philosophy is a deep passion for precision and an unconditional focus on customer satisfaction. In addition to the production of new tools, Fraisa also operates one of the most modern tool reconditioning plants in Europe. Through intensive cooperation with partners, customers, suppliers and universities, Fraisa repeatedly brings breakthrough developments to the market.

www.fraisa.com

WORLD-CLASS SOLUTIONS

In order to construct advanced components for aerospace, for example, new materials such as high-performance plastics and composites are needed. But innovative solutions are needed to turn these into reality. The tool manufacturer LMT BELIN and coating expert CemeCon are paving the way in this market of the future with their developments.

Composite materials are the construction materials of the future. Impetus for the widespread use of composite materials mainly comes from the aerospace and automotive industries. To meet the ever-increasing demands in processing and the diverse applications, innovative tool solutions are needed. LMT BELIN is just such a provider of innovation. As part of the „Composites Excellence" initiative within the LMT Group, the French company develops and manufactures high-performance tools for machining CFRP, aluminium and titanium. In addition to a comprehensive standard program for these applications, it also provides customer-specific solutions tailored especially to individual needs.

Jean Luc Francioli, Application Engineer at LMT BELIN. (Photo: LMT BELIN)

„Our tools are in demand across a wide variety of industries because of their diverse applications," said Jean Luc Francioli, Application Engineer for LMT BELIN. „Our extensive expertise and decades of experience form the basis for our research and development. We also need reliable partners who work with the same level of motivation on pioneering solutions. CemeCon is this kind of visionary."

SERVICE LIFE SIGNIFICANTLY INCREASED

With a keen sense for future requirements, CemeCon laid the foundation almost 30 years ago for economical and precise machining of composites with the development of diamond coatings. Today, CCDia®FiberSpeed und CCDia®AeroSpeed® are the gold standard for machining of CFRP and composites. Thanks to the combination of extremely smooth surfaces, excellent adhesion and sharp cutting edges, the fibers in CFRP can be better cut. This results in precise drilling holes with tight tolerances and high surface qualities. Together with the diamond coatings from

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LMT BELIN IN DETAIL

LMT BELIN, headquartered in Lavancia in France, has decades of experience in the processing of plastics and composites. The company is one of the world's leading manufacturers of precision tools for the machining of high-performance plastics, light metals and composite materials, as well as fine drilling work. LMT BELIN, together with LMT ONSRUD (USA), is the research and development center of the LMT Group for composite and plastic tools. Key sectors for the future development of the company definitely include the aerospace and automotive industries. On the occasion of its 50th anniversary, LMT BELIN completely modernized its production facility in Lavancia in order to be able to meet ever-increasing demands.

www.lmt-belin.com

CONTINUED FROM PAGE 17

CemeCon, the refined, precision drills from LMT BELIN machine almost twice as long as competitive products.

In order to ensure smooth functionality of projects, CemeCon works with LMT right from the start. This starts with the planning and coordination of the application and extends all the way to the delivery of the finished tools.„We have worked closely with CemeCon on 13 projects for the aerospace industry, and the results have consistently been a great success! For processing of CFRP, CFRP/Al-Stacks and CFRP/Ti-Stacks, CCDia® coatings are the most efficient solution on the market," said Jean Luc Francioli.

INTERVIEW WITH JEAN CARIOLINI ON THE EXPANDED DELIVERY SERVICE IN FRANCE

FASTER AND MORE FLEXIBLY

You support CemeCon customers in France and have now expanded the delivery service. What exactly does this mean?

JEAN CARIOLINI: Customers in France, such as LMT BELIN, have been using our delivery service for a very long time. We retrieve the tools from the customer, coat them with customized coatings, and take the finished tools back to the customer. Previously, we only offered this service once a week. However, since time plays a crucial role in certain projects, we now make deliveries twice a week and shorten the delivery times even further. In this way, we can respond more flexibly to our customers' needs.

Which coatings are included in the delivery service?

JEAN CARIOLINI: Customers from France who use our pickup and delivery service have access to all the innovative coatings from CemeCon. They have the opportunity to refine their tools with our diamond coatings. And they also have access to the full range of PVD coatings, including the latest HiPIMS developments.

Jean Cariolini, Area Sales Manager at CemeCon in France and Switzerland.

NEW SUBSIDIARY IN JAPAN

CEMECON K. K. IN THE LAND OF THE RISING SUN

Many of the latest technological developments are made in Japan or in collaboration with Japanese companies. In addition to basic consumer goods and robotics, this is also true for the tool industry. Japanese tool manufacturers have a worldwide market share of around 25 percent. It is as if this highly sophisticated and trendsetting market was created especially for CemeCon.

"Japan is one of the technological leaders of the world. For us – as one of the world's leading coating experts – the strategic decision to invest in the land of the rising sun was based on pure logic. With the establishment of CemeCon K.K in 2016, we can now provide tool manufacturers there with immediate access to our innovative coatings and systems, as well as to our latest developments, both in the diamond and PVD areas," said Dr. Toni Leyendecker, CEO of CemeCon AG.

As the Managing Director of CemeCon K.K., Alexander Marxer is the perfect man on-site for the new subsidiary. Not only has he lived and worked for the last ten years in Japan, which means that he knows the local customs, he also has many years of experience in the PVD sector.

CemeCon has had an excellent reputation in Japan for a long time. The patented multi-layer diamond coatings, which have been repeatedly implemented in CFRP processing, are used with great success by many major tool manufacturers there. The use of the extremely smooth, hard and tough HiPIMS coatings is on the rise and raising great interest. It's no wonder as they are vastly superior to conventional arc coatings and offer enormous opportunities in coating construction.

Alexander Marxer,
CEO CemeCon K.K.

OUR NEXT EVENTS 2016 / 2017

12. - 17. SEPTEMBER 2016
IMTS
Chicago (USA)

13. - 17. SEPTEMBER 2016
AMB
Stuttgart (Germany)

11. - 12. OCTOBER 2016
6. Aachener High Performance Cutting (HPC) Conference
Aachen (Germany)

17. - 21. NOVEMBER 2016
Jimtof
Tokyo (Japan)

1. - 2. DECEMBER 2016
RSD Conference
Gent (Belgium)

26. JANUARY - 2. FEBRUARY 2017
IMTEX
Bangalore (India)