

FACTS

CC800[®]/9 – the success model High-end coatings for nearly every purpose

Pages 10-11



Machining titanium and aluminum with CC AluSpeed[®] Reducing cutting-edge build-up

Pages 4-5

Coating material HSN²: Meeting the challenge of “hard cases”

Pages 8-9

Photo: Pokorn Frästechnik GmbH & Co. KG



Bright spots and outlooks

Dear FACTS reader, ...



Dr. Toni Leyendecker
CEO CemeCon AG

... we enjoy looking back on what happened in 2011. It was a successful year in which we could see once again a huge increase in demand for high performance coatings. Due to the increasing challenges in cutting tool operations, this trend will continue in 2012. CemeCon focuses on providing a large selection of premium coatings and services for the tool manufacturer just to meet these challenges. With them he can develop and manufacture high quality precision tools and through this kind of specialization he can differ significantly in the market.

In this issue of FACTS you will find examples of how manufacturers use our products to establish the most ambitious precision tools for the machining of titanium, aluminum or even hard steels. We are pleased that our products and services can now be offered in England and India. Please read more on pages 6-7 and 10-11.

Prepare to be inspired!
Yours sincerely,

Dr. Toni Leyendecker

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10/11

**The CC800®/9
with full
performance in India.**

Joint trainee project

Focussing on teamwork



Consistently good quality and top service are entirely dependent on the people behind them. CemeCon's conviction that in-house training pays off, even in the high-tech industry, has long since been crowned with success. The trainees grow in the company and become familiar with the diverse areas of the technology from first-hand experience. These areas formed the subject of a recent presentation by our trainees to their fellow students at the Vocational College of Herzogenrath during a plant tour.

In late 2011 CemeCon staged the first plant tour for the Vocational College of Herzogenrath, which was organized fully independently by the trainees. Taking their cue from the "teamwork" theme, they came up with a concept for presenting their training company in the best light. To this end, the trainees independently planned and organized a plant tour and guided their fellow students through the company during the tour.

The aim was to show the various trainee vocations available in the company and to present CemeCon to the instructors and the school officials, based on the full production chain for a coating process.

"Especially in a high-tech company like CemeCon, it's necessary to explain a few things. For example, you can't expect every student in the vocational college to be familiar with the subject of coatings. For this reason, it made a lot of sense to put together a tour with detailed explanations in order to give our fellow students an overview of CemeCon and what we do," explained Katharina Kehren, who is training to become an industrial sales representative at CemeCon.

Experiencing high-tech

Accordingly, Ms. Kehren first provided a theoretical overview of CemeCon and

its products in a company presentation. The vocational students also received a practically oriented insight into coating technology. For this purpose, they were split into groups and guided through CemeCon's coating center in Würselen by group leaders Katharina Kehren, Stefanie Pöppinghaus, Anna Thelen and Christoph Maaßen. Professional backup during the plant tour was provided by staff from CemeCon's Product Management department, who stood ready to answer questions at the four production lines for indexable cutters, shank tools, hobs and diamond coatings. This way every stage of the tool coating process, from incoming delivery to coating and shipping, was explained.

The feedback from the students and the instructors was entirely positive. Peter Koch, HR staff member at CemeCon: "That's why we plan to make tours by vocational school classes a permanent feature on our events calendar. In our opinion, there's no better or more authentic way to present a company. It's also a good example of why it's important to provide education and training to create a good basis for qualified staff." ■

Reducing cutting-edge build-up

Along with innovative carbon- and glassfiber-reinforced plastics (CFRP and GFRP), the traditional lightweight metals, titanium and aluminum, are still in fashion and are used in large quantities. However, neither of these materials is noted for its good machinability.

Nowadays almost everything needs to be light, and for good reason. Weight savings in cars and aircraft translate almost directly into lower fuel consumption and therefore better environmental performance. In an era marked by rising environmental awareness and the need to conserve resources, innovative as well as traditional lightweight materials are increasingly important – especially titanium and aluminum.

Titanium: light but difficult to machine

Titanium and its alloys have always been preferred materials for lightweight construction, in part due to their good ratio of strength to specific weight. They also react quickly and reliably with atmospheric oxygen to form a non-conductive passivation layer that protects them against surface corrosion. This prevents electrochemical corrosion, making titanium and its alloys ideal for use in combination with CFRP – a standard combination in the aerospace industry.

One of the most commonly used titanium alloys is TiAl6V4. It has an extremely fine grain structure, composed of a hexagonal and a cubic phase. To further improve its fracture toughness and fracture propagation characteristics, TiAl6V4 is β -annealed, usually at temperatures above 980°C. Titanium is also used extensively for medical implants due to its biocompatibility.

Titanium's high thermal capacity and low thermal conductivity are just two of the obstacles to machining this material. "Compared to steels, for example, cutting temperatures with titanium alloys are more than twice as high at comparable cutting speeds. The heat load on the cutter is so high that neither the chips nor the workpiece can remove the heat properly. This shows why titanium is so difficult to machine," explained Manfred Weigand, Round Tools Product Manager at CemeCon AG. Another factor is the thermal conductivity of titanium and its strong tendency to adhesion due to heat build-up in the cutting zone, resulting in high stress

on the cutting edges or even total tool failure.

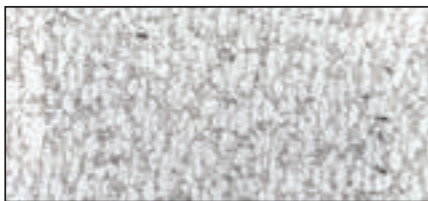
The coating makes the difference

"Although the negative properties of titanium are rather daunting at first glance, it pays to get a handle on the difficulty of machining this material. Naturally, choosing the carbide and defining the geometry are the primary considerations in tool design, but with such high heat loading of the cutters it is also important to pay attention to the coating," according to Manfred Weigand. With optimized coating materials and individually adapted tool coatings, the machinability of titanium can be improved immensely.

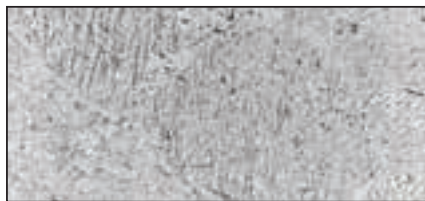
Studies have shown that different coating materials should be used on roughing and finishing tools. The main objective with roughing cutters is to ensure coating adhesion in the face of the forces on the tool and titanium's tendency to adhere to the tool, while finishing cutters need to have sharp edges to avoid chattering and achieve good surface roughness (R_z) figures. Depending on the titanium alloy, CC AluSpeed® or the latest coating material HPN1 are a good choice for roughing, while for finishing only CC AluSpeed® should be used.

Aluminum: strong and accommodating

The best known of the non-ferrous metals – aluminum and its alloys – are considerably easier to machine. Manfred Weigand: "In general the cutting forces with aluminum are lower than with steel of comparable strength. The main problem, aside from the abrasiveness of the silicon in the metal, is the rapid build-up of metal adhering or welded to the tool. This highly adhesive material blocks subsequent chips, and in the worst case they simply tear away the material along with



TiAl6V4 α/β



TiAl6V4 β -annealed

The widely used titanium alloy TiAl6V4 is used in various grades, of which the annealed grade has distinctly higher strength.

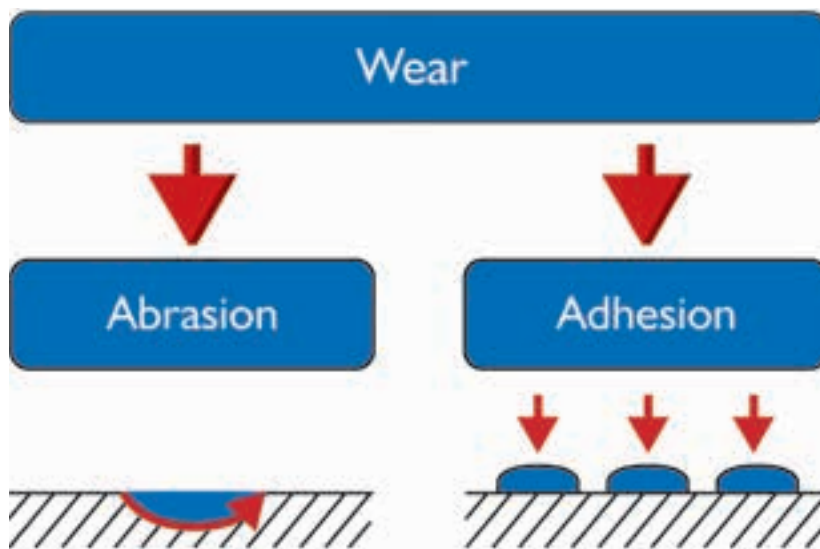
the carbide. Tool design should therefore concentrate on good chip removal." This applies to both extruded and cast aluminum, although cast aluminum can usually be machined somewhat more aggressively.

On the good side with CC AluSpeed®

CemeCon's sputtering process has proven to be a good choice for coating cutting tools for aluminum and titanium.

Along with high coating hardness, the top priority is minimizing friction for chip removal from the cutting zone. Manfred Weigand: "One of the main advantages of the sputter technology is the very smooth surface. After the coating process, the tools do not have to be finished by expensive processes. The low friction of the coating reduces the temperature during the cutting process. This property is very important in cutting of sticky materials as well as material with a low thermal conductivity."

CemeCon developed the coating material CC AluSpeed®, which is based on TiB_2 , for use with both aluminum and titanium. This light grey material allows coatings with very high contour conformance to be achieved, even on sharp cutting edges, and it features high toughness together with very high hardness. "CC AluSpeed® provides optimal protection against material build-up because it has extremely low adhesion to non-ferrous metals. The forces and torques on the tool are therefore significantly reduced, and users can achieve distinctly longer tool life compared to uncoated tools," according to Manfred Weigand. However, CemeCon recommends a multilayer diamond coating from its CCDia® family if it is necessary to machine materials with silicon content higher than 7% to 9%. The high hardness of diamond coating provides the best protection



The abrasiveness of silicon in aluminum and the tendency of the metal to adhere to tools hamper machining of this non-ferrous metal. CC AluSpeed® reduces tool wear.

against abrasion by the silicon in the workpiece material.

Perfectly smooth coatings

Coatings made from CC AluSpeed® are distinguished by perfect, droplet-free surfaces. This minimizes friction and wear and reduces material adhesion to the surface. The net result are tools with a longer life time and better cutting characteristics. The combination of smoothness and extremely high toughness also results in excellent surface quality, eliminating

the need for time-consuming rework in many cases. The surface quality of the coating causes chips to be released faster and enables higher cutting speeds. Manfred Weigand: "Carefully designed coatings give end users a boost in cost effectiveness in machining titanium and aluminum alloys. This creates headroom for further improvements in tool performance for future applications in the automotive and aircraft industries." ■

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CC AluSpeed® in detail

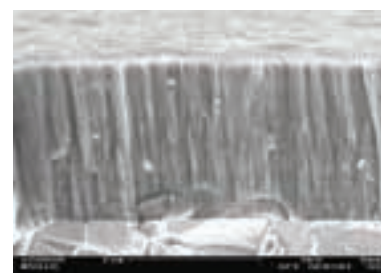
CC AluSpeed® coating material

2±0.7 µm

Characteristics

Composition: TiB_2
Coating structure: columnar
Microhardness: 4.000 HV_{0.05}
Use temperature: 1.100°C

- ✓ Finishing and roughing
- ✓ Wet machining
- ✓ HSC
- ✓ HPC



CC AluSpeed® is the first choice for titanium and aluminum alloys.

Less friction, longer component life

Tecvac has a long record in offering contract services for hard coatings. Since Tecvac's site near Cambridge is close to the British aerospace industry and the famous Formula 1 valley, machine components play a dominant role in its day to day coating production. The demand had been growing so strongly that Tecvac were looking for an extension of its machine capacity – and found it in the CemeCon CC800®/9 coating machine.

Component parts – either being used in automotive or in aerospace applications – are exposed to constant friction and wear and thus need protective means, especially if increased service intervals and process stability are desired. For such demands modern, individually tailored coatings are needed. Tecvac focuses mainly on highly specialised coating jobs for all kinds of components in small series down to prototype products, thus flexibility was at the top of the list of their requirements. Secondly, an easy to use and fully accessible recipe editor is crucial for tailoring the coating process to workpiece and application. All that they found in CemeCon coating machines like the CC800®/9 XL.

Flexibility is the key

Does a CemeCon coating machine, known for its roots in the cutting tool industry, fit into the requirements



Either in small series or as prototype: Tecvac focuses on coating components using the CemeCon sputter technology.

park of a coating service provider for components? Very well, according to Richard Burslem, site director of Tecvac. “Our engineering team did check the equipment and got what we were looking for: a full automatic, highly flexible machine capable of delivering a wide range of hard coatings”.

As coating products get more and more application specific, Tecvac's development path is becoming more and more diverse. Using the physical vapour deposition (PVD) sputter technology, coatings can be applied to titanium, steel and advanced alloy surfaces. For Tecvac, the sputter technology combines all the properties needed by their customers at a reasonable cost and reproducible quality, such as corrosion resistance, erosion resistance, high adhesion and hardness, a low friction coefficient, excellent surface finish and thermal stability.

New coatings in next to no time

Coating structures always differ in certain parameters which decide if they are appropriate to the desired application or if they are not. Therefore the coating machine has to be very flexible during usage and within the design process of a coating – just like the CemeCon sputter technology. With that, there is virtually no limit in

the choice of elements. It opens up a wealth of opportunities regarding the selection and combination of coating materials. Thereby the sputtering technology makes designing dedicated coatings simple and it offers smooth, droplet free coatings a major factor for component manufacturers.

Once the user has decided about the coating's objectives and the material to be coated the rest is up to the recipe tailored for the very coating job. “And that is done very easily and quickly”, states Christoph Schiffers, CemeCon Sales Manager Europe. “Only a few clicks through the machine's display and in next to no time you have designed a new individual coating. Considering parameters like pretreatment, coating material, coating thickness, tolerance, colour and post-treatment you can design coatings that meet the exact purposes of the tool or component.”

The coating machines are not only flexible in their programming routines, they are also designed for flexibility in the shopfloor: The targets which provide the coating material can easily be changed, thus offering a fast switching between different coatings. Christoph Schiffers: “The CC800®/9 comes with a software suite that gives full access to the coating recipes by a mouse click”. Offline programming while the machine is running and a remote control mode are additional features which make coating design even easier.

Training to get started rapidly

For CemeCon an intensive customer training is integral part of every machine project. Although working with the CC800®/9 is almost self-explanatory, some additional training helps the plant operator to get familiar with the

machine, write his own recipes and makes coating design even quicker. "We always adapt the training to the customer's needs, and we do it 'live' at the machine with a real product", Christoph Schiffers adds. Following a hands-on approach a joint Tecvac/CemeCon team developed the coating recipe for a Tecvac customer project during the training. Within a few days the machine was installed and the first batch of coated products was ready for shipment. "We were absolutely inspired," Richard Burslem states. "We chose the CemeCon technology for its easy-to-handle interface but how should we know it was that easy designing our own specific coating solution? And most important: Our customer was satisfied with the fast response to their order and the high-quality coating we provided!"

Ready for new challenges

Adding a new piece of equipment to an already smooth-running production is always exciting. "Also for the sales department", according to Ian Haggan, Tecvac's sales manager. "Through the



The Tecvac-Team is inspired by its new CemeCon coating machine CC800®/9 XL. That is how they design their individual coating in next to no time.

immediate realisation of the first coating job for components we gained a lot of confidence in the equipment and its flexibility – and therefore to win additional business". With new projects

in prospect, the company expects that future developments will come in the form of increasingly hard wearing, tribologically advantageous coatings allowing for lighter weight materials to be used for critical structures. "With a flexible machine technology and close co-operation with CemeCon we don't fear demanding new projects and we are looking forward to being challenged", Richard Burslem concludes. ■

Tecvac in detail



Tecvac, part of The Wallwork Group, offers ultra hard coating, ion implantation, heat treatment and vacuum brazing service from a custom built site near Cambridge. The coatings offered are most suitable for high value precision components and tools such as surgical implants and instruments, aeroengine rotables, gas turbine blades, precision gears and bearings, motorsport components, flexible printing dies etc. A qualified R&D team supports dedicated coatings for highly specialised applications and prototype jobs.

The company also designs, builds and services a range of PVD coating, ion implantation and specialist vacuum equipment for customers world-wide, with plant installed in more than 20 countries. Furthermore Tecvac will market CemeCon's diamond coating products. The Tecvac team will support customers in England and Ireland in using diamond coatings for applications like graphite and composite machining.



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Meeting the challenge of “hard cases”

Extremely tough, hardened hot-working steels are commonly used nowadays to make injection molds and forming dies. The tools used to produce them must therefore be robust enough to stand up to extremely hard materials rated up to 70 HRC. The supernitride material HSN² is ideally equipped to meet this challenge, and it helps extend tool life.

Materials used in molds and dies making are often both hard and tough, and the alloy elements that increase their corrosion resistance also make them more difficult to machine. This means that the tool coating must deliver more than the usual coating can offer. Inka Harrand, Product Manager Cutting Inserts at CemeCon, comments:

“Machining materials with hardness ratings of 60 HRC or more is a job for specialists. This also applies to the tools and their coatings, which must be able to meet very severe requirements and handle very high loads. Our silicon-doped coating

material HSN² is specifically targeted at applications of this sort and forms the ideal basis for specially designed coatings for machining extremely hard materials. Silicon forms very fine crystallites, thereby creating smooth surfaces and a compact crystal structure. We developed HSN² for these cases, and we have already used it in numerous customer projects with good results.”

Pursuing higher performance

HSN² is a latest-generation supernitride produced by using the sputtering technology which gives users full freedom of choice for the chemical elements used in their coatings. The specific elements that are crucial for achieving optimal coating performance for machining hard materials can be vaporized in the plasma. Special targets (the base material) ensure reproducible quality from the first to the final batch. “What’s more, the coating method makes HSN² especially smooth because droplets cannot form on the coating with the sputtering method. This results in optimal chip and heat removal,” according to Inka Harrand.

Modern tools for molds and dies making are designed for highest precision to enable process security for machining within very tight manufacturing tolerances. This applies equally well to larger-dimensional face mills with indexable inserts for bulk material removal on flat surfaces as well as solid carbide round tools for vertical work. Thanks to the smooth coatings, both types can also be used for finishing because they can produce mirror-like surfaces in a single machining operation. This could eliminate the need for polishing.

They take the fear out of the hardest materials: tools with coatings on the basis of HSN².



Photo: Pokorn Frästechnik GmbH & Co. KG



Photo: HAM GmbH

HSN² is available in various coating thicknesses from 1.0 μm to 4.0 μm to meet specific customer needs. This is very important because cutting tools differ not only in diameter, but also very much in geometry.

Depending on the manufacturer, radius or ballnose end-mills with diameters down to 0.1 mm are available as standard. Premium quality, extending from the substrate to precisely ground geometry, is essential for achieving long life times and process security, especially with such small tools. This is where CemeCon comes into play: in cooperation with the customer we design the coating and specify a suitable working plan.

Tackling hardness even harder

Tool precision and tool quality depend on a high geometry accuracy. Inka Harrand: "The coating can't be allowed to change this. People who design such high-precision tools expect the desired properties to be retained in the coated tools. The coating requirements we fulfill with HSN² are extreme hardness, mechanical load capacity, outstanding coating adhesion and high toughness. Our coatings can be deposited with high homogeneity and reproducibility, even on complex geometries, to enable a long tool life and maximum process security. As PVD coatings are a 'visible line' process, the coating process must be optimally matched to the tools. For this reason, CemeCon decided many years ago to focus on cutting tools, and specifically on precision tools." ■



Photo: Jongen Werkzeugtechnik GmbH & Co. KG

Patience in the machining of materials above 60 HRC yields secure processes and optimal cutting results.

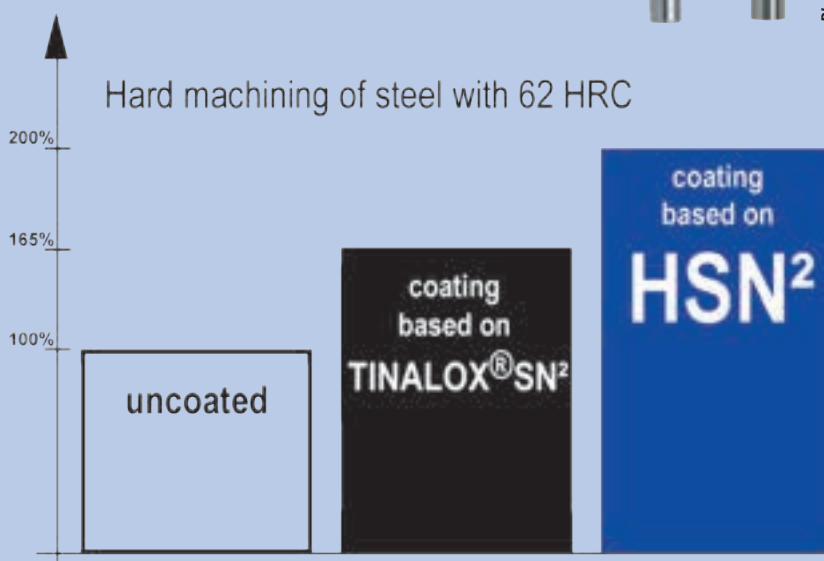
HSN² compared to TiAlN

Material:	1.2379 X155CrVMoV 12 1 62 HRC
Machining:	milling, dry
Parameter:	$v_c = 250 \text{ m/min}$ $f = 0,25 \text{ mm/U}$



Photo: Karnasch GmbH

Tool life



A coating structure based on TiAlN supernitride increases tool life by 65% compared to uncoated tools, and HSN² boosts this to 100%.

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High-end coatings for the Indian market

India is an emerging technological nation. Its metal-working industries are in need of efficient, high-end tools. By offering coatings based on CemeCon technology, Famex Coating India Pvt. Ltd. is promoting the success of India's national and international companies at its coating center in Coimbatore.

According to the International Monetary Fund, the Indian sub-continent is ranked among the top four countries in the world in terms of their gross domestic product, after the USA, China and Japan. The metal-working industry, for example the automobile and plant construction sectors, accounts for a growing portion of this success. This in turn is pushing tool manufacturers to supply this market quickly and effectively with high-end machining solutions.

High-end objective in sight

"We founded Famex Coating India Pvt. Ltd. to serve the Indian market as the number one high-quality supplier specializing in coatings for cutting tools. With our long-standing experience, we plan to offer tool manufacturers and end-users high-end coatings for their tools. Our number one goal is customer satisfaction," emphasizes Mr. Sadashivan, Director of Famex Coating India Pvt. Ltd.



The CemeCon CC800®/9 ML can be loaded and unloaded quickly and easily.

To achieve this, Famex looked for a reliable, experienced coating company "that not only offered the right technology, but was also capable of supporting us in establishing our coating center with appropriate training," adds Soundara Rajan, Director of Famex Coating India Pvt. Ltd. CemeCon fits the bill perfectly. "For us, CemeCon is the right technological partner and also a reliable company that will advise and assist us in the years to come."

Experience and expertise from one source

Technology was the decisive factor in our choice to work with CemeCon: PVD sputter technology and long-standing experience in the operation of coating centers set CemeCon apart as the best partner for Famex. "We knew that customers in India were looking for high-end coatings that meet international standards. We also knew that CemeCon would be able to share their experience with us so that we can supply the Indian market with high-end coatings," emphasizes Mr. Sadashivan.

Ultra-smooth, droplet-free coatings ready for use in a wide range



They want to rise to the leading providers for coatings in the Indian market (from left): Mr. Shankar, Anand Kumar, Bernd Hermeler from CemeCon AG, Mr. Sudhir and Soundara Rajan, Directors of Famex Coating India Pvt. Ltd. focus on coatings for cutting tools.

of industries embody the strengths of CemeCon sputter technology. As machine building, mold-making and the textile industry, not to mention key industries such as automobile and aerospace engineering, account for a significant portion of Famex's customer base, the new technology must also be able to adapt to their requirements. India also has different climatic and technical conditions than Central Europe; this also had to be considered when planning the coating line.

Famex already has the necessary application expertise when it comes to milling, drilling, turning, hobbing as well as hard and dry processing. In order for the coating center to run smoothly from the start, additional technological training was also on the agenda. CemeCon therefore trained Famex technicians at its center in Würselen, familiarizing them with coating technology. More in-depth training sessions were then conducted on-site using the CC800®/9 ML. This made it possible to commission the turnkey coating line at short notice.

Satisfied customers are a good indicator of success

Thanks to CemeCon's support, Famex was able to develop rapidly.



The CC800®/9 ML coating machine is the core part of the turnkey coating line installed at Famex in Coimbatore. Due to efficient and in-depth training by the CemeCon service team the Indian coating center launched at short notice.

"Now, Famex technicians only come to Germany when they receive further professional training," adds Manish Adwani from CemeCon. The first test results from Famex custom-

ers are already very promising. "Our customers tell us that the tool quality produced with sputter technology has dramatically improved in comparison to the conventional ARC technology used by our competitors. With this reputation, we are now well on our way to realizing our goal of becoming the leading provider of coatings in India," proclaims Soundara Rajan proudly.

Famex Coating in detail



Famex Coating India Pvt. Ltd. is a young company that offers outstanding coating service for cutting tools in India. The company is managed by a group of engineers, who together have over 100 years of experience in the application, sale and marketing of machining tools. As a result, the company keeps pace with industry developments while offering comprehensive service covering all work processes, including logistics and regrinding. The company operates a CemeCon-approved coating center in Coimbatore. CemeCon verifies its processes and compares them with applicable industrial standards in regular audits.



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CemeCon Events calendar 2012

March 14th 2012 - March 17th 2012

GrindTec
Augsburg (Germany), Hall 3, Booth 3044

April 16th 2012 - April 20th 2012

CCMT
Nanjing (China), Booth A1-A807

April 23rd 2012 - April 27th 2012

ICMCTF
San Diego (USA)

April 28th 2012 - May 3rd 2012

SVC Annual Technical Conference
Santa Clara (USA)

May 30th 2012 - May 31st 2012

Carbon Based Coatings
Leoben (Austria)

June 12th 2012 - June 16th 2012

CIMES
Beijing (China)

June 19th 2012 - June 20th 2012

HIPIMS 2012
Sheffield (Great Britain)

September 10th 2012 - September 15th 2012

IMTS
Chicago (USA)

September 10th 2012 - September 14th 2012

PSE 2012
Garmisch-Partenkirchen (Germany)

September 18th 2012 - September 22nd 2012

AMB
Stuttgart (Germany)

November 1st 2012 - November 6th 2012

Jimtof
Tokyo (Japan)

November 14th 2012 - November 15th 2012

10th Schmalkalder Werkzeugtagung
Schmalkalden (Germany)

Dezember 13th 2012 - Dezember 14th 2012

RSD 2012
Gent (Belgium)

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