www.cemecon.com

Coating

- Construction
- Production
- Technology

...from one Source!

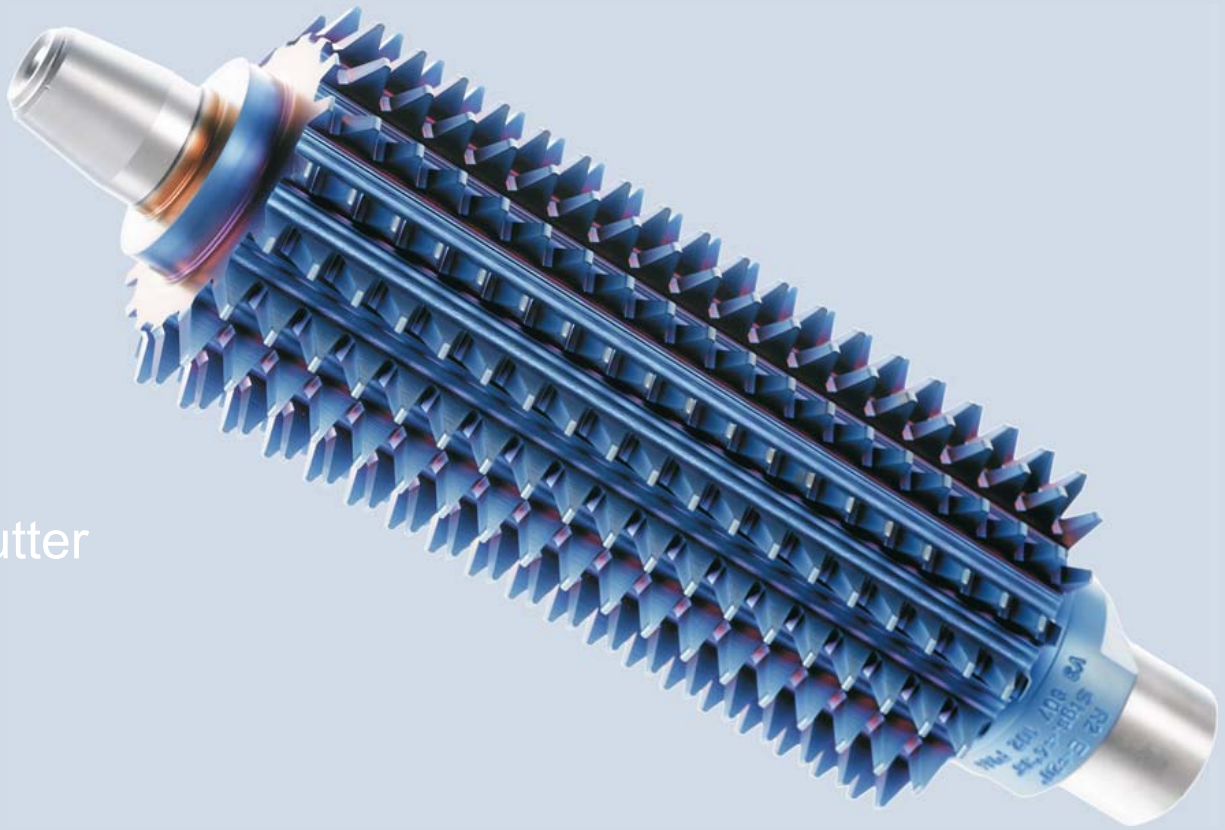
CEMECON

Incorporating Coating Technology
into your business

3rd international seminar on modern cutting and measuring engineering

7. – 9. September 2008, ShenZhen

- **About the CemeCon Group**
- Coating Construction/Production
- Technology Transfer
- Coating Technology CVD Diamond / PVD Sputter
- Cooperation with CemeCon Customers



CemeCon Group

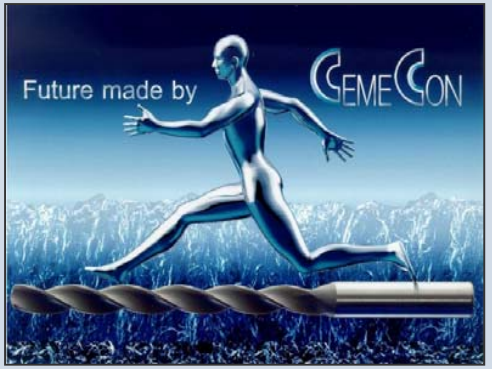
Coatings for high-performance products

We provide

- Customer-Specific coating service for precision tools and components.
- Turn-Key PVD sputter technology, including all peripheral devices for production.
- Customer-Specific high-end coating process developments

CemeCon Group

- Specialised in high-performance coatings of precision tools.
- Leading in diamond coatings.
- Operator of one of the largest job-coating centers in Europe.
- Job-Coating centers in the USA, China, Scandinavia and Czech Republic.
- Provider of coating technology and peripheral外围的 devices for coating development and production.
- 380 employees worldwide, 290 of them in Würselen close to Aachen.



CemeCon Headquarter in Würselen

CemeCon Group

Production Sites

… your coating partner worldwide

CemeCon AG
Headquarter Würselen

CemeCon Inc.
Horseheads NY, USA

Offer:
✓ Coating Service
✓ Technology Transfer

CemeCon Scandinavia A/S
Aabyhoej, Denmark

Offer:
✓ Coating Service
✓ Special-Know-how
Forming and pressing tools

Tianwei CemeCon Coating Technology Co.,Ltd.
Beijing and Suzhou, China

Offer:
✓ Coating Service

CemeCon s.r.o. Tschechien
Ivancice, Czech Republic

Offer:
✓ Coating Service

GCT
Weingarten, Germany

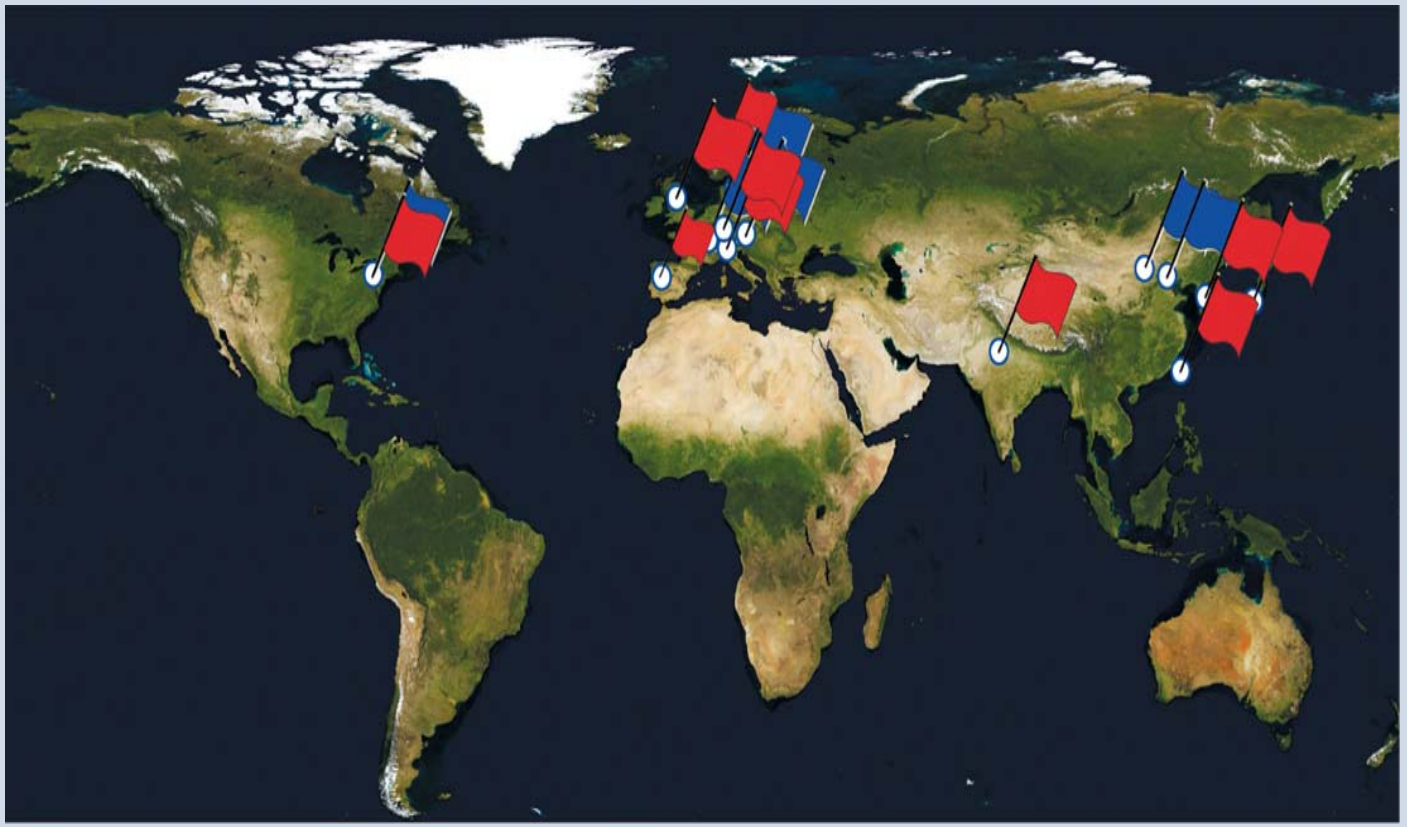
Offer:
✓ Diamond coatings for PCB tools

CemeCon Group

Sales Offices

CemeCon has opened sales offices worldwide to ensure individual support and technology service on the spot and to be even closer to the customer.

- Switzerland
- Great Britain
- Sweden
- Spain
- India
- Japan
- Taiwan
- Korea



Production sites:

- Germany
- USA
- China
- Czech Republic
- Denmark

CemeCon Group

History

- **1986** Foundation of CemeCon by Dr.-Ing（engineer). Antonius Leyendecker in Aachen
- **1988** Presentationof the coating material TiAIN.
- **1990** Opening of the coating centre in Aachen.
- **1992** Presentation of crystallinediamond coatings.
- **1998** Foundation of CemeCon Inc. in the USA.
- **1999** Relocation of the coating centre to Würselen.
- **2000** Presentation of the CCDia production line.
  New development of the coating system CC800®/9.

CemeCon Group

History

- **2001** CemeCon becomes the biggest coating centers in Europe
- **2004** CemeCon opened coating centers in Scandinavia, Application Development Center (ADC) and coating centre in Suzhou, China.
- **2005** A second coating centre is opened in Beijing, China
- **2007** CemeCon launch of second generation CC800/9 (AS2)
- **2008** CemeCon coating centre is opening in Czech Republic
  HPPMSPatents are bought by CemeCon
  CemeCon China becomes WFOEwithin CemeCon AG.

Future made by CemeCon

Coatings for high-performance products

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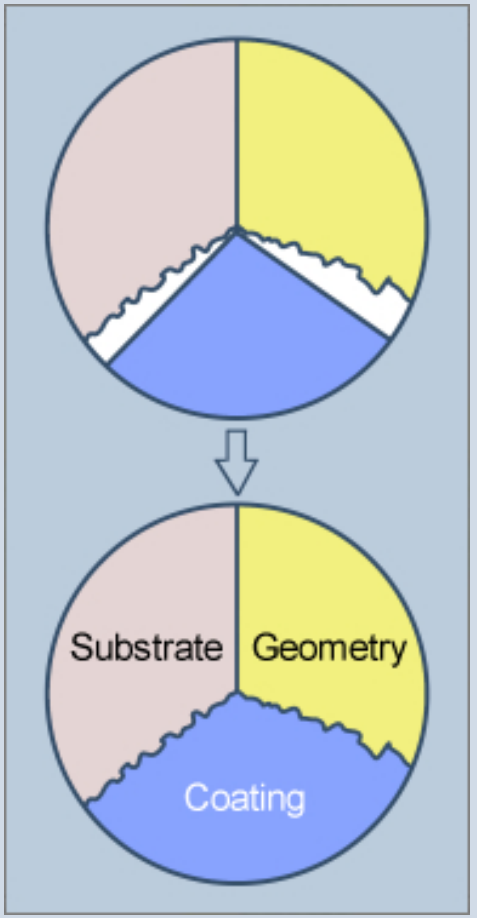
Coating Construction

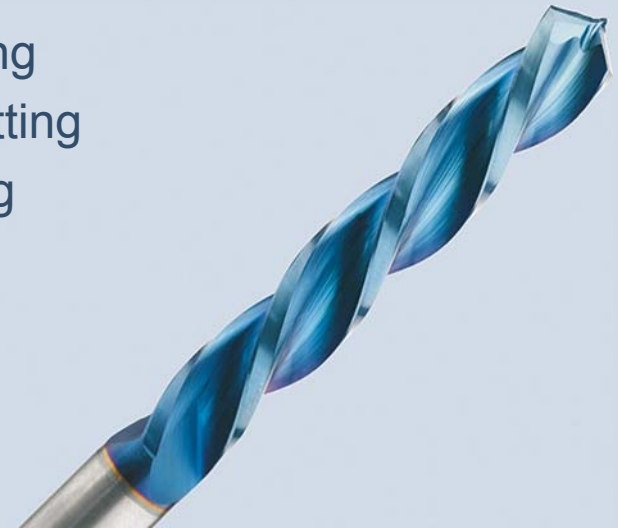
CemeCon provides

the designing and production of customer specific high-tech coatings for precision tools.



Our competences for different applications:

- Drilling
- Turning
- Milling
- Reaming
- Threading
- Gear cutting
- Grooving

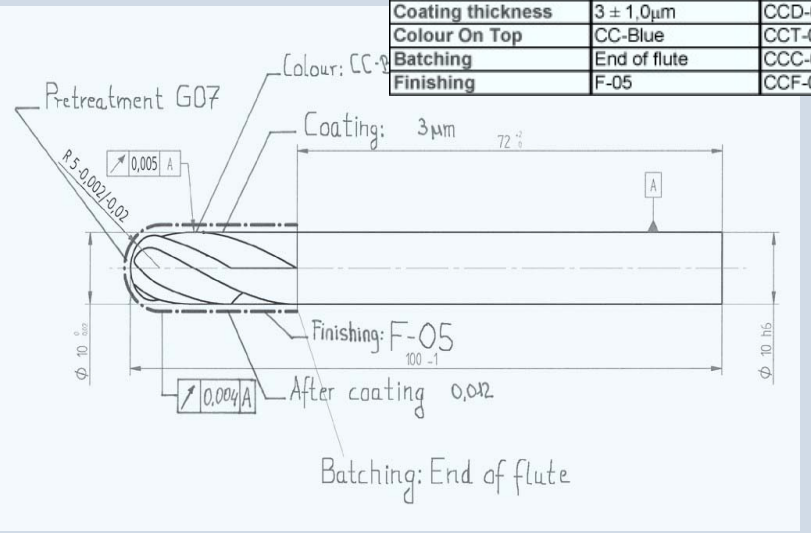


Coating Construction

Designing and production of a coating

Coating = pre-treatment + coating material + coating thickness + tolerance + colour + post treatment

Cleaning	US	CCR-009
Pretreatment 1	G-01	CCV-106
Pretreatment 2	G-07	CCV-207
Coating material	Hyperlox	CCB-005
Coating thickness	3 ± 1,0µm	CCD-030
Colour On Top	CC-Blue	CCT-006
Batching	End of flute	CCC-012
Finishing	F-05	CCF-002



Your own coating in four steps:

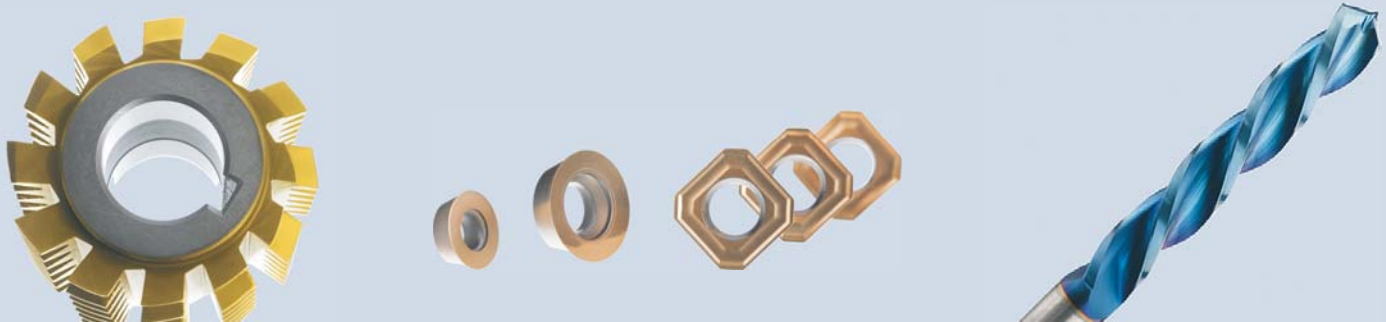
1. Definition of the objective
2. Determining of coating specifications
3. Production of test tools, evaluation and, if necessary, optimization
4. Finalisation of the specifications

Coating Production

Production of coatings

on customer order (coating service)

- CemeCon produces your designed coating in one of the world largest coating centres.
- Production of 3.000 different coating variants and up to 60.000 tools every day.
- Different production lines for Insert, Round-Tool and Hob.



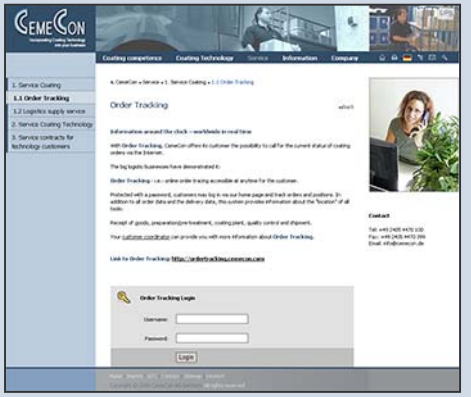
Coating Production

Logistic supply service

- A coated tool in the shortest time – CemeCon‘s logistic supply service makes almost every delivery date possible.

Order tracking

- CemeCon provides online **order tracking**, customers are able to check on the current processing status of their coating order at any time.



Coating Production

Production lines

Each production line has its own complete technology to meet the different geometries and surface conditions of the tools.

Coating Service Cutting Inserts

Coating Service Round Tools

Coating Service Hobs

Coating Service Diamond

Coating Service Molds

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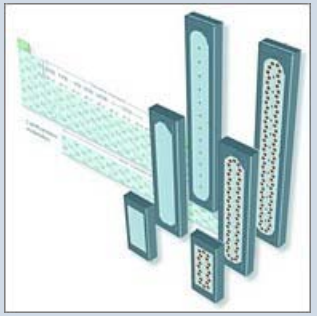


Technology Transfer

Coating Systems

CemeCon provides the technology for your in-house coating including systems technology, peripheral devices and turnkey systems.

- Our systems technology is based on the proven coating system CC800®/9.
- On this platform we deliver systems for large, medium and small coating volumes (CC800®/9 XL, CC800®/9 ML, CC800®/9 JET).
- CemeCon systems provide proven coating technology for precision tool manufacturers' and tool grinders' production.
- For R&D departments and universities we deliver customized equipment based on the industrial proven platform.

Technology Transfer

Coating Systems
CC800®/9 Dia

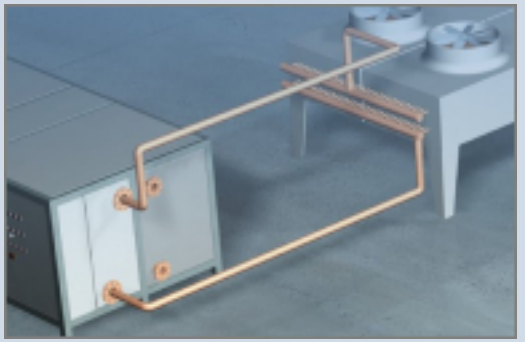
With the CVD diamond coating process, CemeCon has been able to coat tool geometries three-dimensionally with the hardest material in the world since the early 90s.

In this process, the pure diamond grows in polycrystallineform on the substrate surface.

Technology Transfer

Peripherals 外围设备

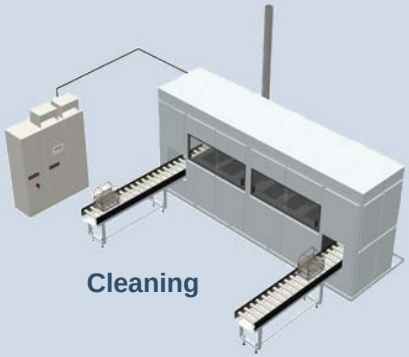
We do not just provide the coating technology for our customers but additionally all peripherals required for the operation of their own coating center (turnkey).



All peripheral devices are precisely aligned with one another, thus contributing to the overall success of the coating operation and increasing the productivity and profitability

Technology Transfer

Peripherals

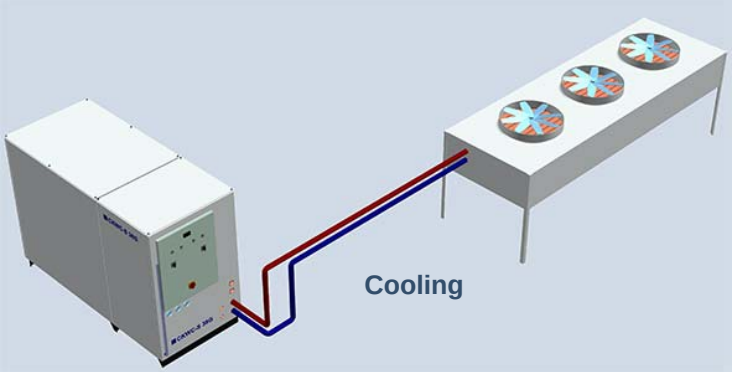


Cleaning

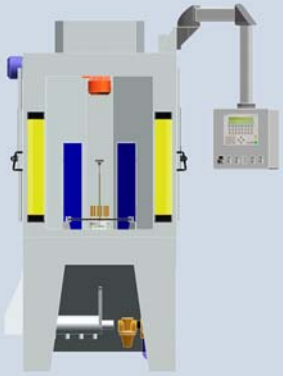
The following are some of our coating system peripherals:

- cooling System
- Diverse wet and dry blasting systems
- Cleaning systems
- Devices for testing the product quality

Air pressure



Cooling



Surface preparation

Technology Transfer

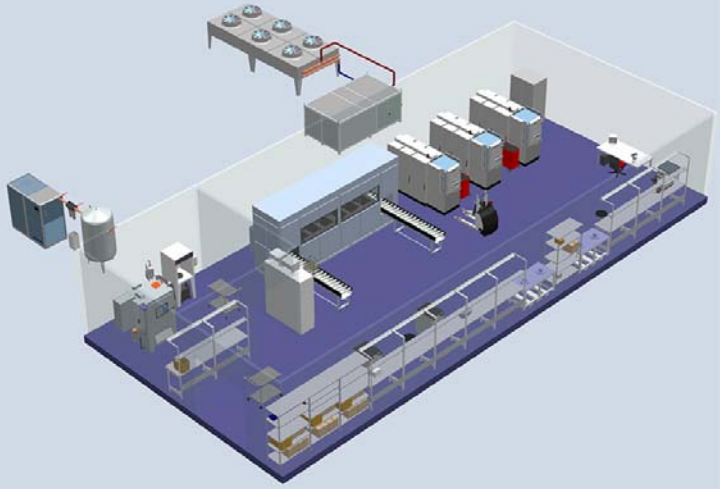
Turnkey Solutions

As project partner, CemeCon has overall responsibility for the complete turnkey solution.

Our customer service team takes care of delivery, floor-plan布局规划, preparation of your factory, set-up + instalation and training of your staff.

CemeCon gives you full service support until you are ready for production !

- Reduce the reaction time to customer wishes
- Reduce logistical expenditure
- Transportation costsbetween your own plant and the job coater no longer apply
- Quality benefits by designing the production chain to your own product range
- Maximum flexibility and efficient work processes



Technology Transfer

Benefit from numerous advantages with your own coating technology

- ✓ Reduce logistical expenditure
- ✓ Reduce the reaction time to customer wishes
- ✓ No transportation costs between your own plant and the job coater
- ✓ Quality benefits by designing the production chain to your own product range
- ✓ Maximum flexibility and efficient work processes

Technology Transfer

Customer Care – always one step ahead

- Experienced team of service engineers provides unlimited access to our technical support – no matter where you are in Europe, USA or in Asia/Pacific.
- Intensive training by skilled personnel.
- On-site installation of CC800®/9 comprising complete peripheral equipment and production ramp up.
- Preventivemaintenance programmes guarantee highest availability.
- Service engineers look for quickest solution – 24/7 by telephone, internet-/modem access or directly on spot.

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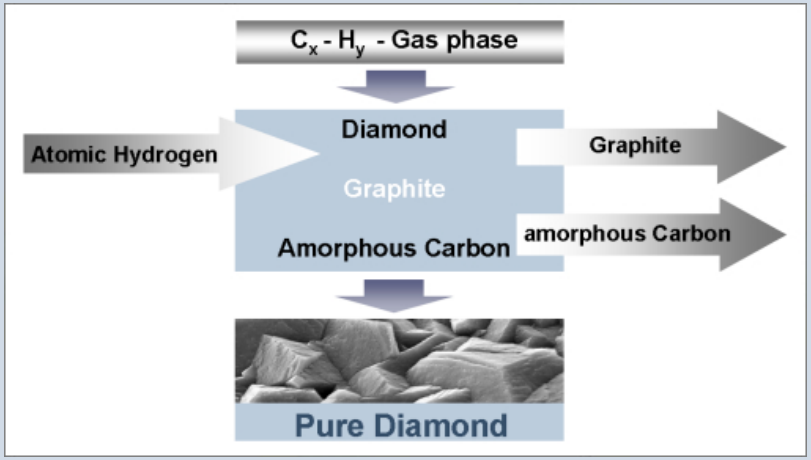
Coating Technology

CVD-Diamond

The hardest material in the world on your tool geometries.

- CC800 Dia systems deposit in highest quality nano crystalline and multilayer diamond coatings on cutting inserts and shaft tools.
- Diamond coatings are first choice when machining abrasivematerials such as graphite aluminium-silicon alloys and fibre-reinforced materials.



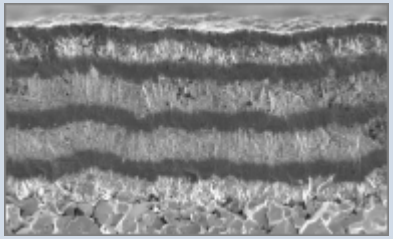
Coating Technology

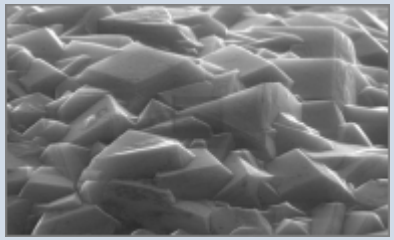
CVD-Diamond

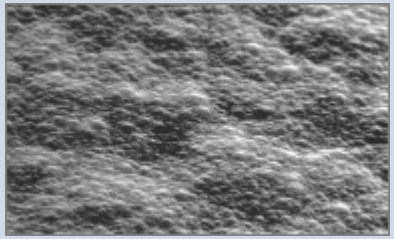
The hardest material in the world on your tool geometries.

Characteristics of CemeCon diamond coatings:

- ✓ extremely abrasion resistant 。
- ✓ high level of hardness of 10,000 HV0.05
- ✓ high heat conductivity 。
- ✓ economic: high performance increase, maximum tool life
- ✓ can be used for high feeds, e.g. during AlSi processing
- ✓ no binder phase







Coating Technology

CFK - machining

Indispensableand competitive advantage in the aircraft industry

Carbon fibre reinforced plastics (CFRP) have been indispensable in aerospace industry for a long time.

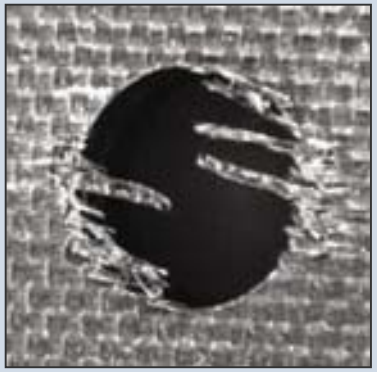
With multilayer diamond coatings the user receives ideal conditions to also machine such highly abrasive materials economically.

Coating Technology

CCDia®FiberSpeed – Drilling of CFRP

CFRP platter is machined with a diamond coated countersink drill.

The result with an optimized drill is a clean drilling hole without CFRP detamination.

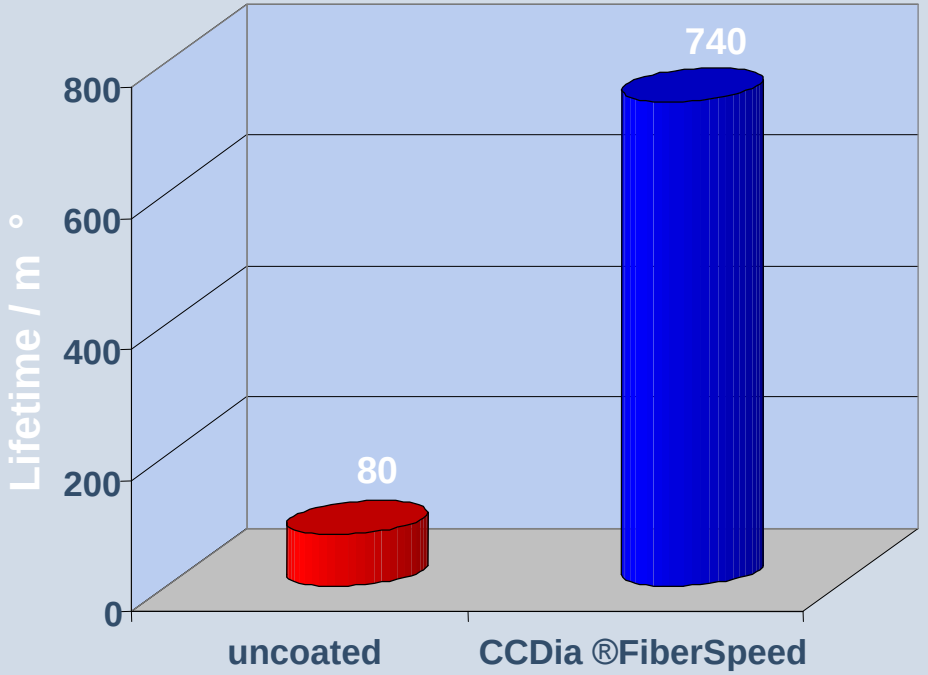


Drilling hole with standard drill.

Coating Technology

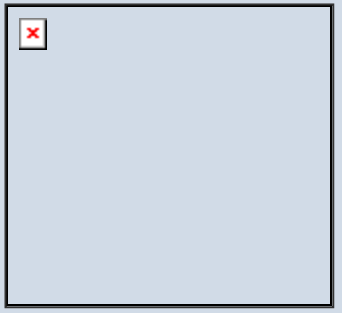
CCDia®FiberSpeed – Milling of CFRP

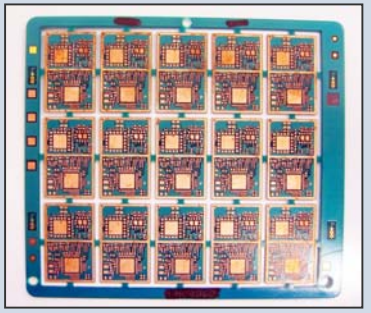
- **900% higher Lifetime**
  - coating: CCDia®FiberSpeed
  - cemented carbide: EMT100/ Extramet
  - tool: Cutter Ø 8mm
  - material: Al-Ti-CFK (ML)
  - cooling: dry
  - performance criterion: wear
- **Cutting Parameters**
  - v_c = 250 m/ min
  - f_z = 0,20 mm/z



Coating Technology

Application - PCB

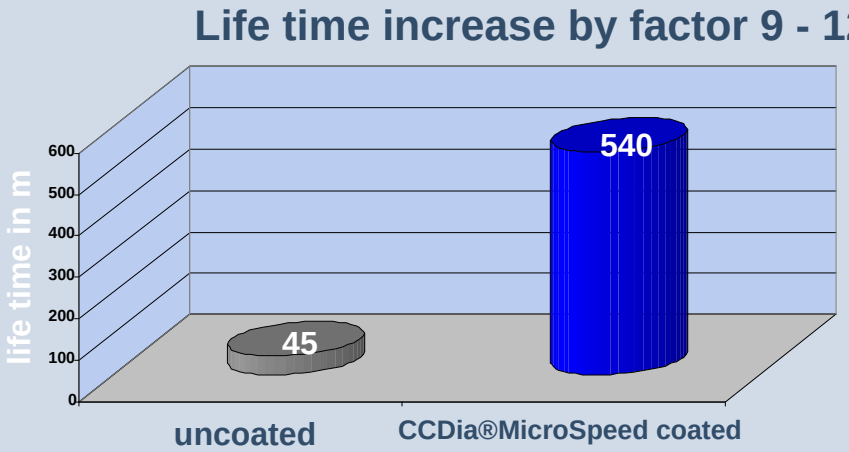




Example: Routing of FR4

- FR4,3panels per stack, through hole plating with a thickness of 1,55 mm
- Router type: 1 100 2000 090 (diameter ø 2.00 mm, spiral geometry,
- coating CCDia® MicroSpeed,
- tool manufacturer: GCT GmbH
- rev n=32000 1/min, advance f=1.2 m/min, right slight tolerance ± 0,1 mm

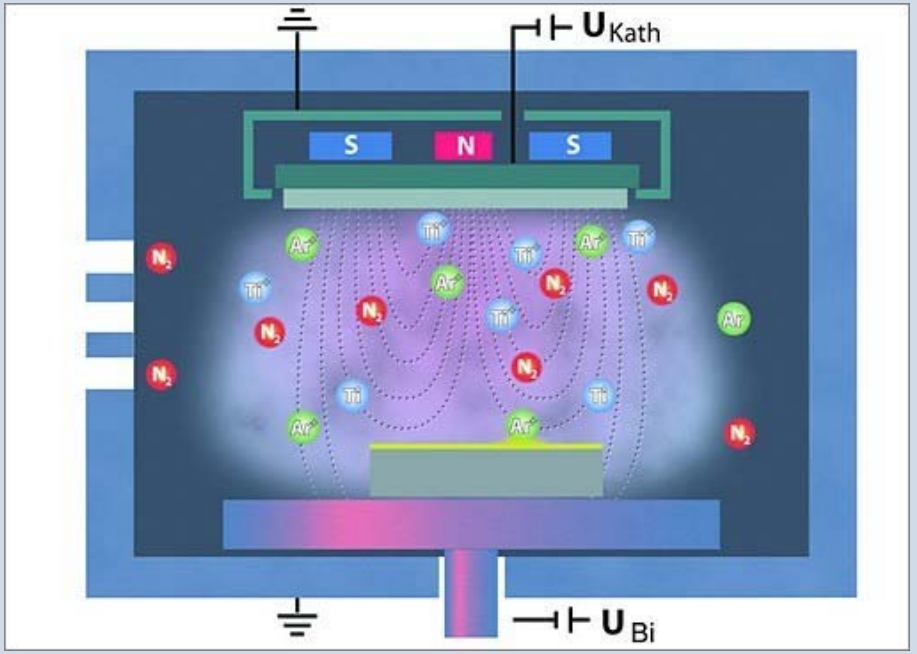
- → From 45 m the tool life could be extended by 9 – 12 times to 540 m.



Coating Technology

PVD Sputter Coating Technology

The sputter technology provides various possibilities regarding the selection and combination of coating materials.



Market leader in sputter technology

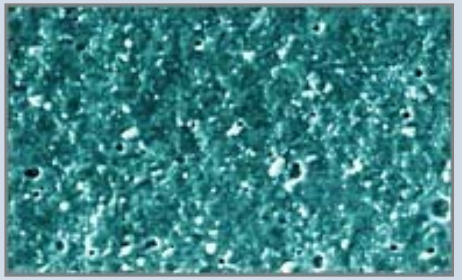
The sputter PVD process has formed the basis for high quality coatings for 20 years. During this time, we have developed coating systems which make economic processing of new materials possible for the first time and lead to a improvement in the performance of the application. Proof of this is provided by numerous patents for coatings, processes and technology. Already 1988, CemeCon succeeded in applying TiAlN coatings on an industrial scale.

Coating Technology

Advantages of CemeCon PVD Sputter Coating Technology

- ✓ extremely smooth
- ✓ high degree of hardness and temperature hardness
- ✓ extraordinarily high level of adhesion
- ✓ oxidation-resistant
- ✓ low friction
- ✓ virtually no residual stress
- ✓ no rounding of the cutting edges
- ✓ cost-effectively production of large and small batches
- ✓ flexible choice of coating material
- ✓ assured of a good future as virtually all conductive and non-conductive materials can be applied to all substrates

Sputter layer enlarged 2000x



Arc layer enlarged 2000x

Coating Technology

CC AluSpeed®

The light grey coating material **CC AluSpeed®** was especially developed for high-performance machining of aluminium and aluminium alloys.

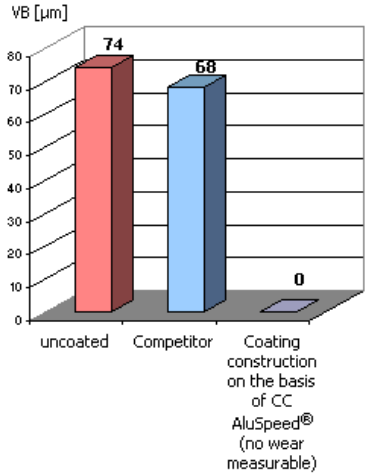
With its low affinity to aluminium, AluSpeed prevents the formation of built-up edges to a particularly large extent. The extremely smooth surface reduces friction on the face and makes machining easier. Accurately constructed the high degree of hardness also guarantees excellent wear protection.

Example: Milling of AlSi1MgMn

Application

Material:	AlSi1MgMn
Tool:	Carbide end mill, Ø 8mm
Parameter:	n = 38 200 rev/min
	v_c = 960 m/min
	f_z = 0.084 mm/t
Cooling:	MQL

No wear at high cutting speed

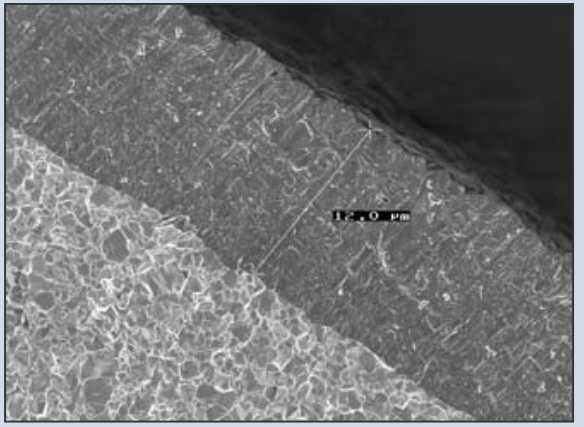


Coating solution

Performance criteria:	Wear
Result	
Coating construction on the basis of CC AluSpeed®:	No wear
Competitor:	68 µm
Uncoated:	74 µm

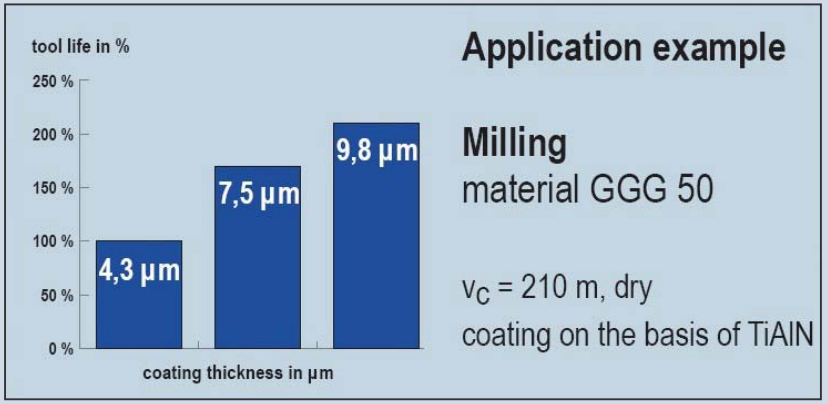
Coating Technology

“Thick” coatings on cutting inserts



Numerous benefits with the PVD method

- High performance coating materials for turning- and rough milling applications in all steel- and cast irons materials
- Coating thickness up to 12 µm with very high adhesion
- Typical areas of application of CVD-coatings
- The high wear volume of the coating guarantees long and reproducible tool life
- High oxidation resistance
- Extremely smooth through sputter technology
- Good toughness at very high hardness through nano structure



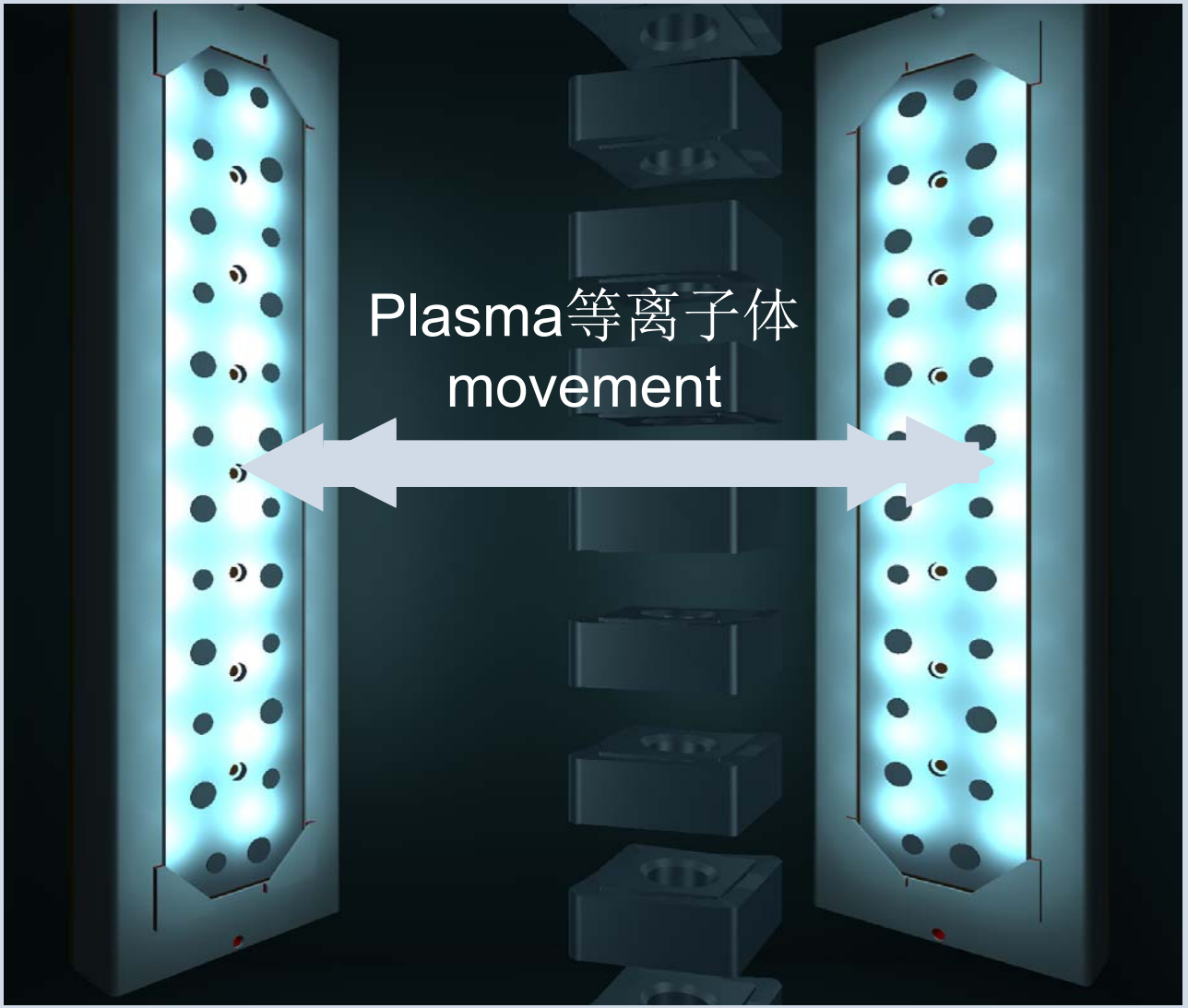
Coating Technology

Oxide Coatings

- pulsed dc - etching
- High Ion Sputtering (H.I.S.)
- High Ion Pulsing (H.I.P.)
- 4 high power magnetrons
- 4 DC power supplies
- 4 pulsed power auxiliaries
- triode wiring
- DC bias
- pulsed bias

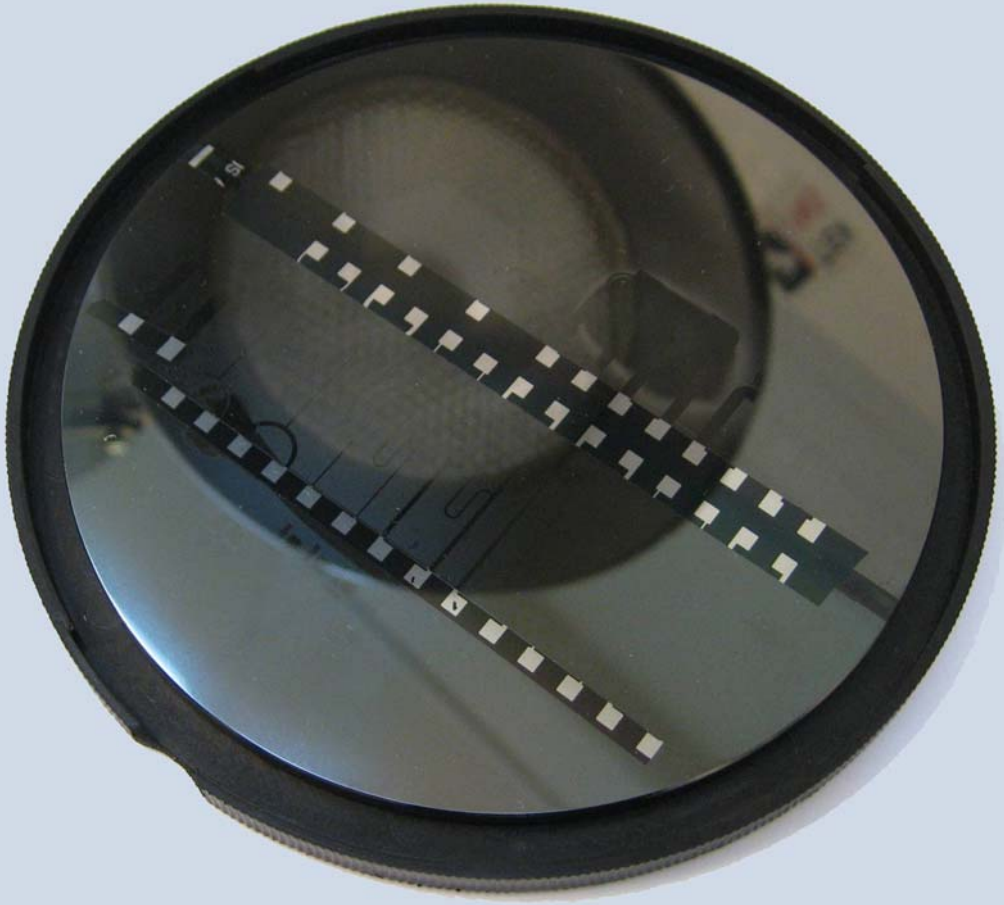
Coating Technology

Bipolar Dual Cathode Sputtering



Coating Technology

aluminum – oxid based pt 100-sensort material on wafer material



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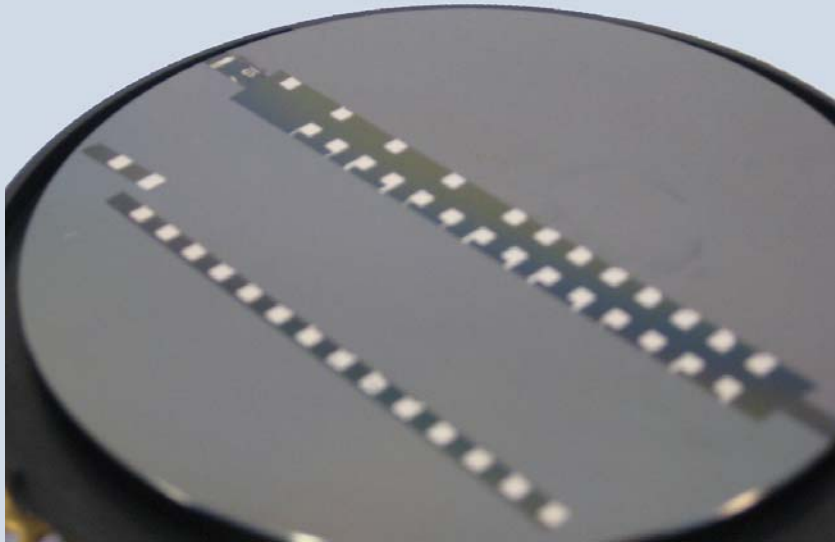
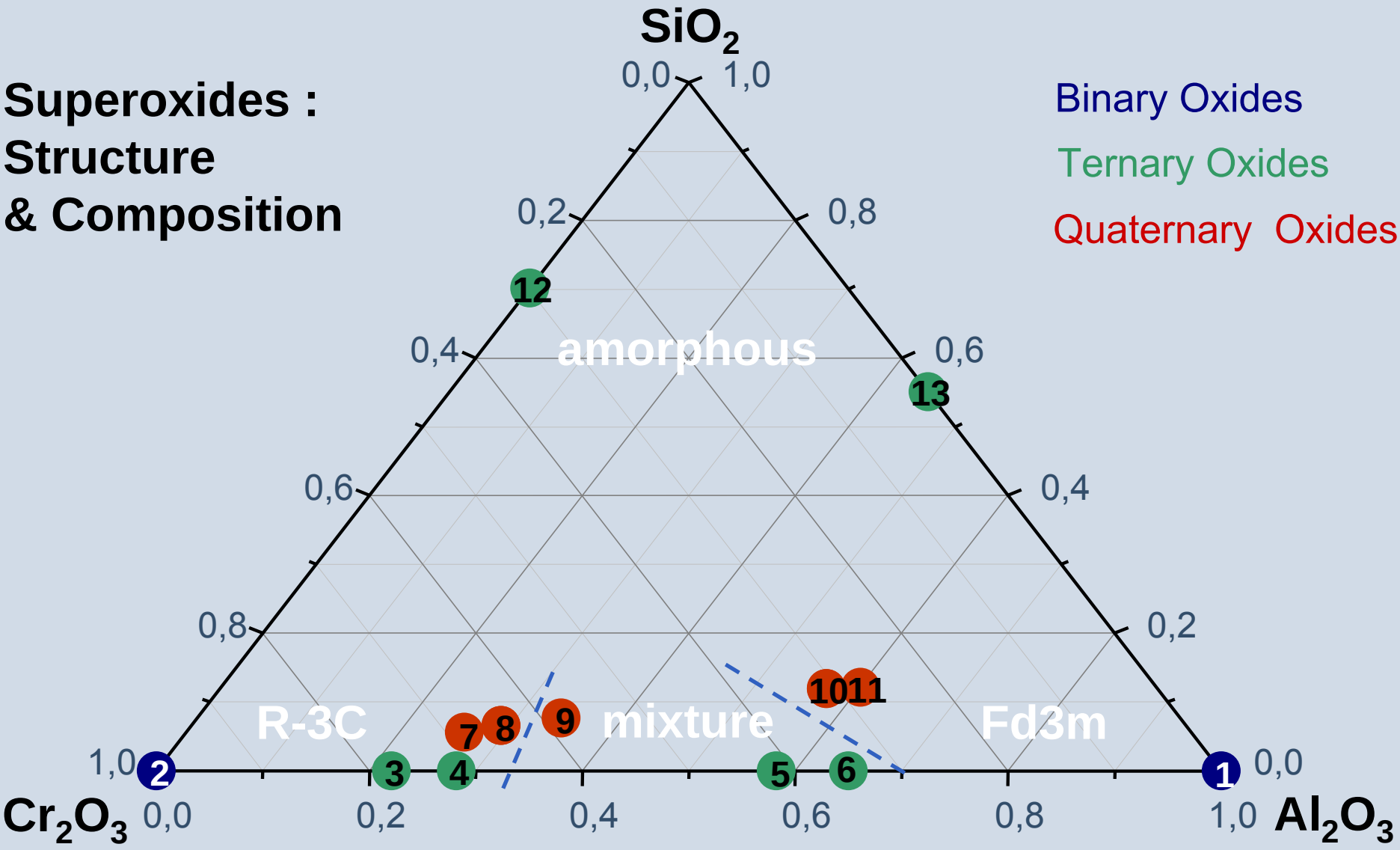


Coating Technology

Superoxides : Structure & Composition



Binary Oxides

Ternary Oxides

Quaternary Oxides

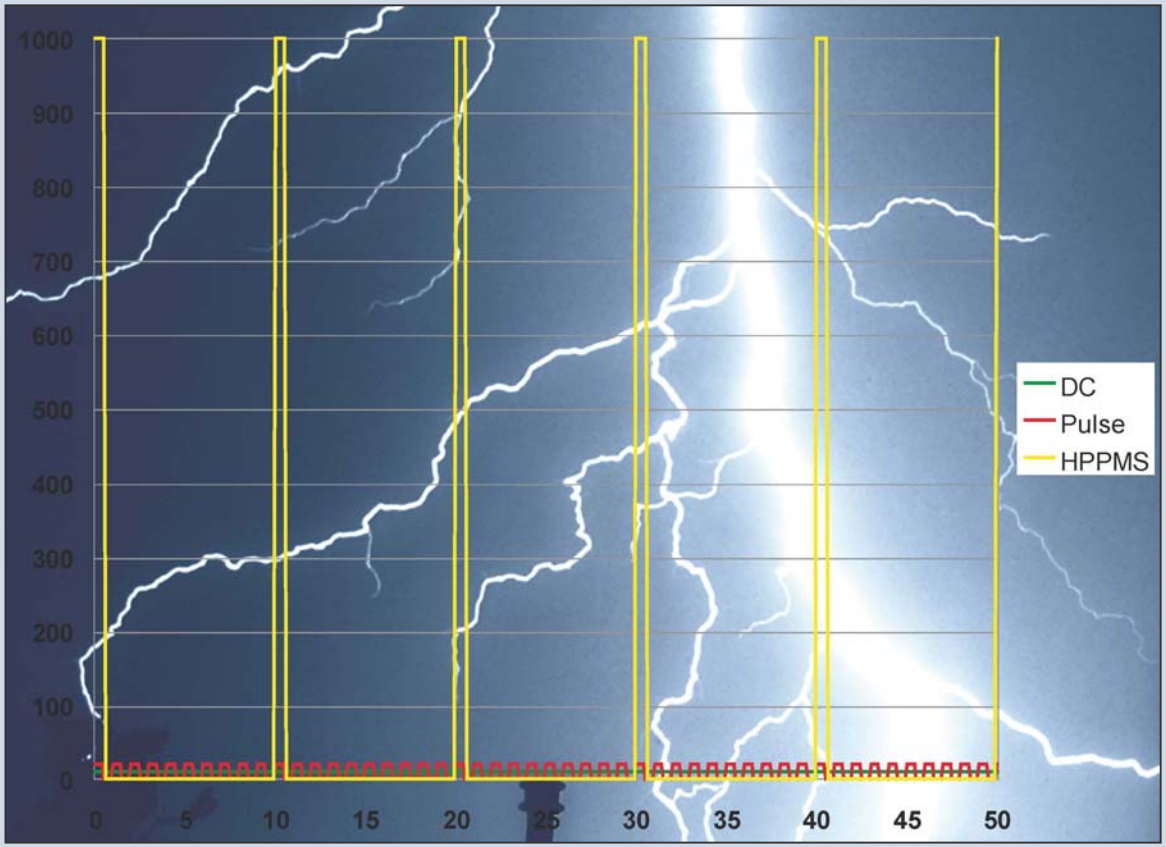
Coating Technology

HPPMS - High Power Pulsed Magnetron Sputtering

A substantially better adhesion of the tool coating can be achieved by the HPPMS technology. The interest of the experts worldwide for this pioneering further development of the sputtering process is accordingly high.。
A special power supply is important for the production of the ion pulse in the megawatt range. Chemfilt developed such a device for the HPPMS sputtering procedure and formulated essential patents for the auspicious technology.。
With contract from 09 September, 2008 CemeCon takes over the knowledge, patents as well as the complete technology of Chemfilt for the production of the High Power Pulsed Sputter Technology.

Coating Technology

HPPMS - High Power Pulsed Magnetron Sputtering



CemeCon is owner of HPPMS Technology patents Chemfilt

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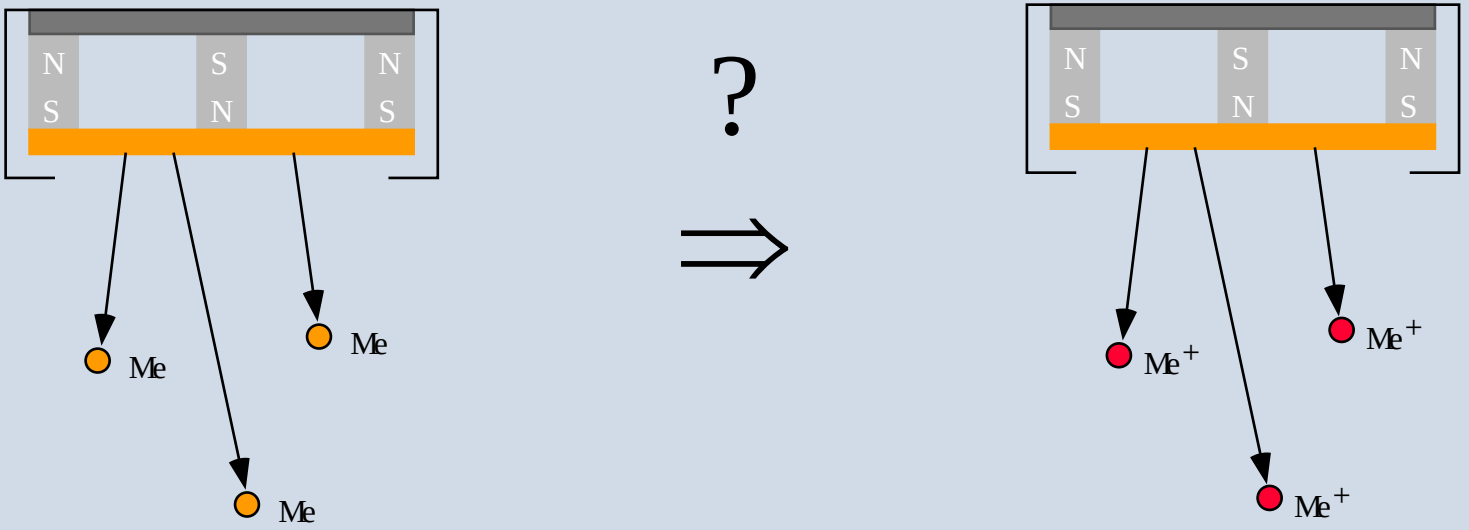
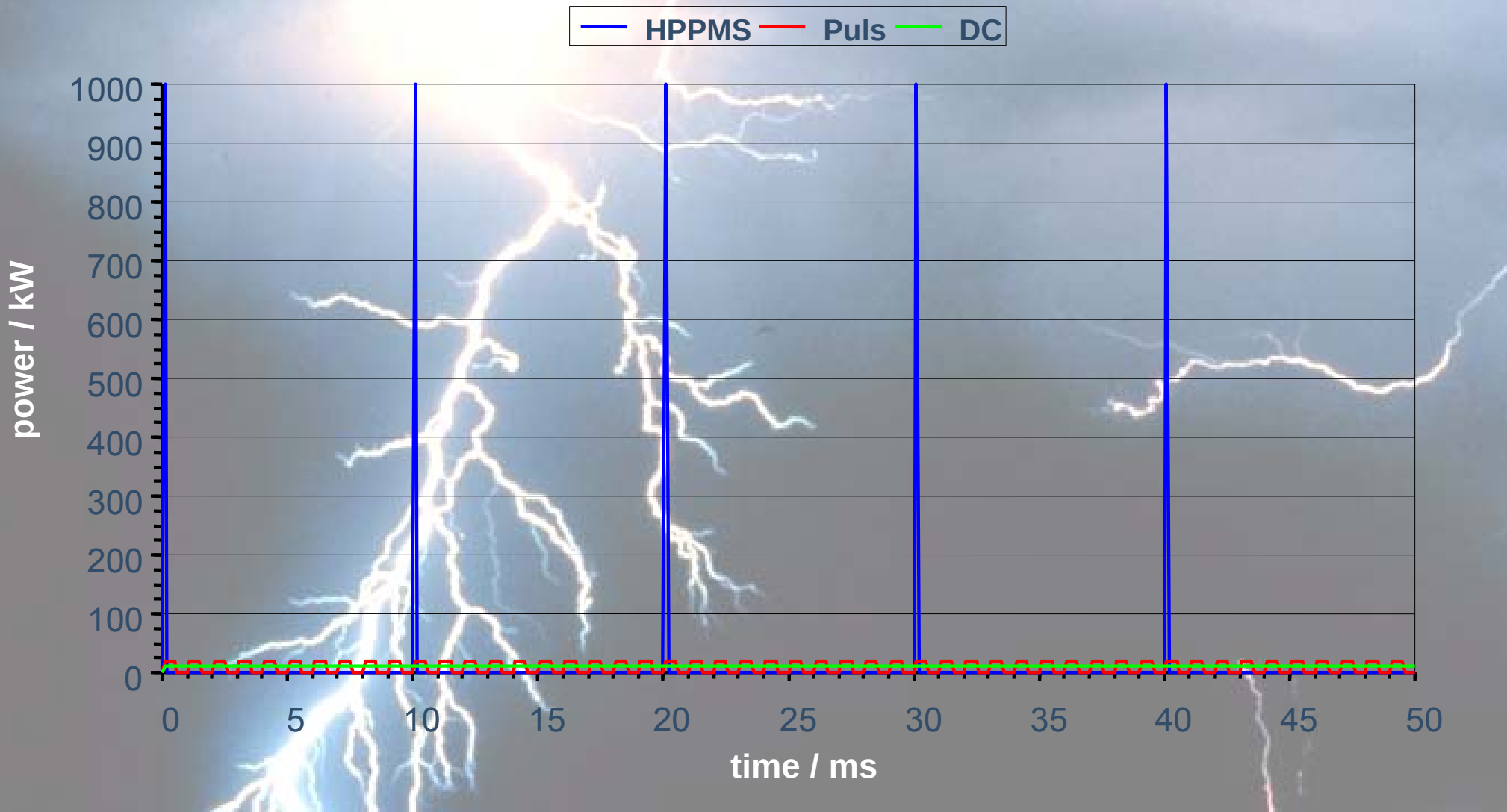
How to turn a conventional source into an ion source?



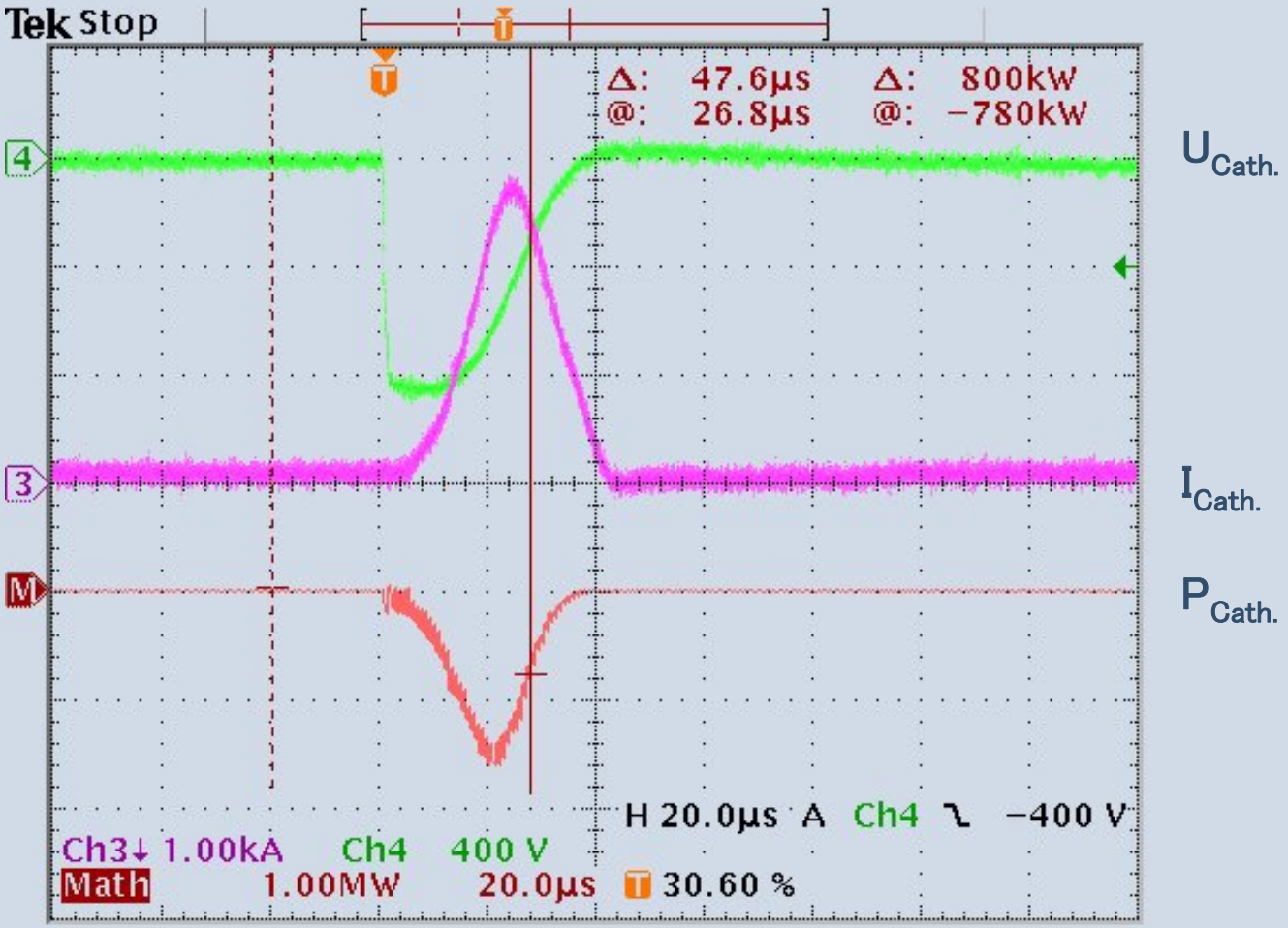
Needed: Plasma density ~ 10^{19} m^{-3}, Normal sputtering: 10^{16} m^{-3}

Coating Technology



Coating Technology

1,5 MW puls power at 800V



$U_{Cath.}$

$I_{Cath.}$

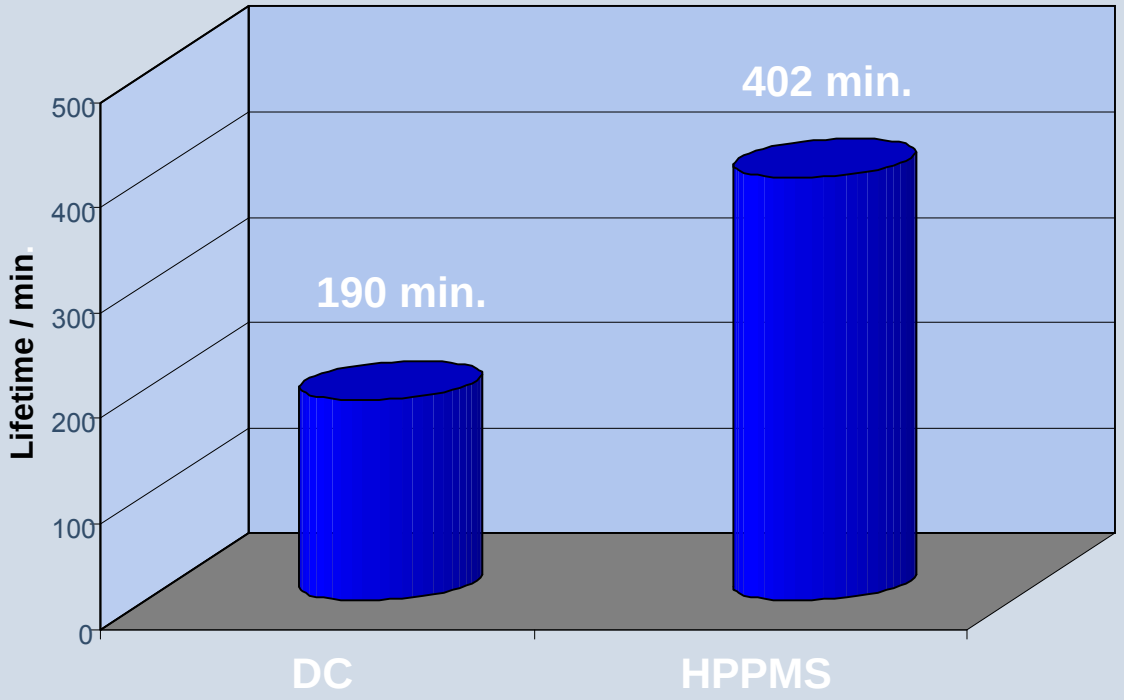
$P_{Cath.}$

Coating Technology

Milling with Super Nitrides, Hard Machining

Cutting Parameters

Speed:	**6000 rpm**
Feed rate:	**3500 mm/min**
Depth of cut:	**0.5 mm**
Work piece material:	**X38CrMoV51 (H11 Mod.)**
Dimensions:	**150x200x330 mm**
Ball nose end mill:	**Carbide, 10 mm**
No coolant	
Reference coating:	**TinaloxSN²**
	tool life: 190 min.
HPPMS coating:	**tool life: 402 min.**

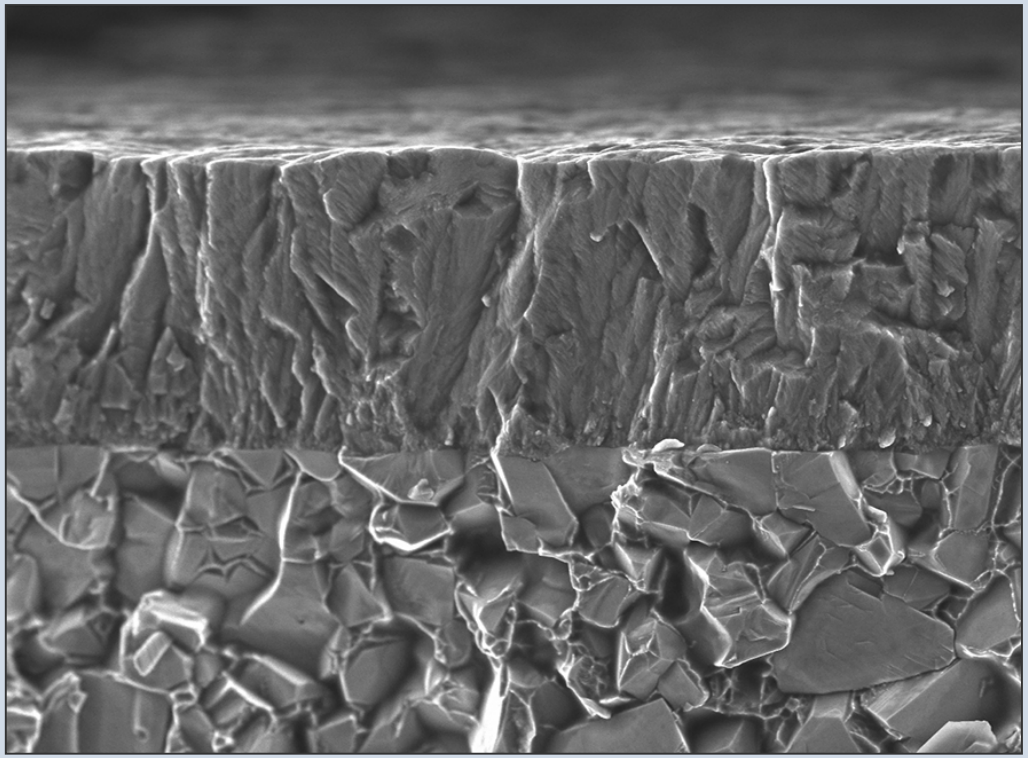


Coating Technology

HPPMS - High Power Pulsed Magnetron Sputtering

Advantages

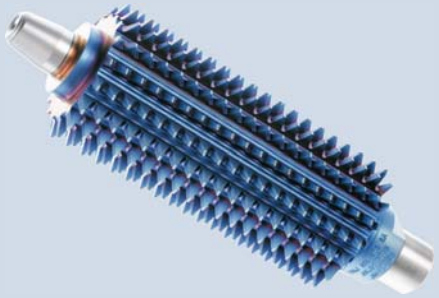
- High deposition rates
- Optimized Adhesion
- Outstanding coating uniformity
- Scalability from R&D to production size
- Excellent performance
- Proven reliability
- CemeCon-functionality
- Fully automated
- Industrial availability
- Average HPPMS-cathode power up to 4x10 kW

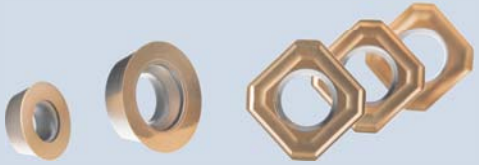


Future made by CemeCon

Coatings for high-performance products

- About the CemeCon Group
- Coating Construction/ Production
- Technology Transfer
- Coating Technology CVD Diamond / PVD Sputter
- **Cooperation with CemeCon Customers**





CemeCon Customers

...Thank you for your attention!