



# COATING

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Success Stories





## CVD Coating

Name	Material	Microhardness HV 0.05	Friction Coefficient	Coating Temperature (°C)	Thickness [µm]	Max. Application Temperature (°C)	Color	General Characteristic	Application Recommendations
CVD TiC	TiC	3.700 ± 500	0,2	~1000	max. 9	300	gray metallic	<ul style="list-style-type: none"> <li>» Extremely high hardness</li> <li>» High adhesive strength</li> </ul>	<ul style="list-style-type: none"> <li>» Drawing, punching, pressing and forming tools: Machining of ferrous metals and sheet steel (especially stainless steels)</li> </ul>
CVD TiC/TiN	TiC/TiN	2.700 ± 300	0,6	~1000	8 – 10	500	gold	<ul style="list-style-type: none"> <li>» Very high hardness</li> <li>» High adhesive strength</li> </ul>	<ul style="list-style-type: none"> <li>» Indexable inserts in machining or roughing of not too strong steels</li> <li>» Drawing, punching, pressing and forming tools for aluminum clad or galvanized galvanized sheets</li> </ul>
	TiN/TiC	3.000 ± 300	0,2	~1000	max. 10	450	grey metallic	<ul style="list-style-type: none"> <li>» Very high hardness</li> <li>» High adhesive strength</li> <li>» Higher hardness compared to TiC/TiN</li> </ul>	<ul style="list-style-type: none"> <li>» Drawing, punching, pressing and forming tools: Processing of ferrous metals and steel plates (especially for thicker plates with high surface pressures)</li> </ul>

### CVD = Chemical Vapour Deposition

Is a coating process in which thermally induced chemical reactions at temperatures of approx. 1000 °C are used to initiate coating synthesis from a specific gas mixture-precursor combination.

The CVD coatings can be deposited on hard metal or steel materials. CVD-coated steel substrates have to be post-hardened by a subsequent heat treatment in order to restore the defined microstructure and the necessary supporting effect of the base material. CVD is used as a coating process for increasing wear resistance, especially for the forming industry, but is also used in various applications in machining production.

## PVD Coating

Name	Material	Microhardness HV 0.05	Friction Coefficient	Thickness [µm]	Max. Application Temperature (°C)	Color	General Characteristic	Application Recommendations
CARBON-X®	a-C : H	2.400 ± 400	0,05 – 0,15	1,5 – 2,5	325	black gray	<ul style="list-style-type: none"> <li>» Maximum wear resistance due to high coating hardness</li> <li>» Low coefficients of friction and reduced adhesions</li> <li>» High tool performance and running performance</li> </ul>	<ul style="list-style-type: none"> <li>» Cutting of non-ferrous metals</li> <li>» Cutting of non-ferrous metals</li> <li>» Cold forming</li> <li>» Plastic injection molding and components</li> </ul>
CARBON-X®-AL	a-C : H	2.400 ± 400	0,05 – 0,10	3 – 4	325	dark grey	<ul style="list-style-type: none"> <li>» Maximum wear resistance due to high coating hardness</li> <li>» Low coefficients of friction and reduced adhesions</li> <li>» High tool performance and running performance</li> </ul>	<ul style="list-style-type: none"> <li>» Forming of aluminum</li> </ul>
CrN	CrN	2000 ± 600	0,3 – 0,4	1 – 6	600	slate gray	<ul style="list-style-type: none"> <li>» High hardness and adhesion</li> <li>» Very good chemical resistance</li> <li>» Low coefficient of friction against steel</li> <li>» High air temperature resistance</li> <li>» Low residual stress</li> <li>» Thicker layers possible</li> </ul>	<ul style="list-style-type: none"> <li>» Metal forming</li> <li>» Plastics processing (improved demolding, corrosive and abrasive wear)</li> <li>» Aluminum and magnesium die casting</li> <li>» Machining of non-ferrous metals</li> </ul>
CrCN	CrCN	2.300 ± 200	0,2 – 0,3	2 – 6	600	silver-gray	<ul style="list-style-type: none"> <li>» Hohe Härte und Haftfestigkeit</li> <li>» Sehr gute chemische Beständigkeit</li> <li>» Geringer Reibungskoeffizient gegen Stahl</li> <li>» Hohe Luft Temperaturbeständigkeit</li> <li>» Niedrige Eigenspannung</li> <li>» Dickere Schichten möglich</li> </ul>	<ul style="list-style-type: none"> <li>» Metal forming</li> <li>» Plastics processing (improved demolding, corrosive and abrasive wear)</li> <li>» Aluminum and magnesium die casting</li> <li>» Machining of non-ferrous metals</li> </ul>
CrN Multilage	CrN	2000 ± 200	0,3 – 0,4	2 – 6	600	silver-gray	<ul style="list-style-type: none"> <li>» High hardness and adhesion</li> <li>» Very good chemical resistance</li> <li>» High air temperature resistance</li> <li>» Significantly improved corrosion resistance due to multilayer layer structure (e.g. plastic injection molding: processing of PVC or flame retardant)</li> </ul>	<ul style="list-style-type: none"> <li>» Plastics processing (improved demolding, corrosive and abrasive wear)</li> <li>» Drawing, stamping, pressing and forming dies for the processing of non-ferrous metals (especially Ti, Cu)</li> <li>» Mg die casting (improved demolding)</li> </ul>
CROSAL®-plus	AlCrN	3.200 ± 300	0,45	2 – 5	1.100	slate gray	<ul style="list-style-type: none"> <li>» High oxidation resistance</li> <li>» Excellent hot hardness</li> <li>» Excellent adhesion</li> </ul>	<ul style="list-style-type: none"> <li>» Machining and high performance machining</li> <li>» Gear cutting, dry broaching</li> <li>» Stamping, forming, fine blanking</li> <li>» Hot pressing</li> <li>» Aluminum die casting</li> </ul>

Name	Material	Microhardness HV 0.05	Friction Coefficient	Thickness [µm]	Max. Application Temperature (°C)	Color	General Characteristic	Application Recommendations
DUMATIC®	Duplex TiC-Multilayer	3.700 ± 500 Top layer 2.600 ± 300 Layer composite	0,25	3 – 5	400	reddish-grey	<ul style="list-style-type: none"> <li>» Highest hardness and abrasion resistance for forming</li> <li>» Tough layer structure</li> <li>» Enormous wear resistance</li> </ul>	<ul style="list-style-type: none"> <li>» Cold forming</li> <li>» Cutting of high-strength sheet metal</li> <li>» Cold forming processes with high surface pressure</li> <li>» Drawing, punching, pressing &amp; forming tools for the processing of high-alloy Cr-Ni materials</li> </ul>
Duplex-VARIANTIC®	Duplex TiAlCN	3.500 ± 500		2 – 4	800	old pink	<ul style="list-style-type: none"> <li>» Significant friction reduction</li> <li>» Multilayer structure</li> <li>» High wear resistance</li> </ul>	<ul style="list-style-type: none"> <li>» Grinding and milling of steels</li> <li>» Sheet steel and cold solid forming</li> <li>» Especially for high pressure loads in the tool</li> </ul>
Duplex-VARIANTIC®-1000	Duplex TiAlCN	4.000 ± 200	0,6 – 0,7	ca. 9	800	dark red gold	<ul style="list-style-type: none"> <li>» High layer adhesion excellent abrasive wear protection</li> </ul>	<ul style="list-style-type: none"> <li>» Drawing, pressing and forming tools for the processing of high-strength steels</li> </ul>
Duplex-VARIANTIC®-1400	Duplex TiAlCN	3.000 ± 200	0,05 – 0,15	5 – 7	800	gold	<ul style="list-style-type: none"> <li>» Excellent resistance against abrasive and adhesive wear</li> <li>» Very good adhesion</li> </ul>	<ul style="list-style-type: none"> <li>» Cold forming of steel grades from 1,000 to 1,400MPa</li> <li>» Punching/cutting of steel grades ≥1,000MPa</li> </ul>
EXXTRAL®	AlTiN Monolayer	3.300 ± 300	0,7	2 – 5	800	anthracite	<ul style="list-style-type: none"> <li>» High oxidation resistance (800 °C)</li> <li>» High hot hardness</li> <li>» Chemical resistance</li> <li>» Low heat conduction coefficient</li> </ul>	<ul style="list-style-type: none"> <li>» Milling, drilling, and turning.</li> <li>» No need for cooling lubricant</li> <li>» Forming technology</li> </ul>
EXXTRAL®-plus	AlTiN	3.300 ± 300	0,7	2 – 5	800	anthracite	<ul style="list-style-type: none"> <li>» Particularly smooth and dense</li> <li>» High oxidation resistance (800°C)</li> <li>» High hot hardness</li> <li>» Increased toughness</li> <li>» Chemical resistance</li> <li>» Low coefficient of thermal conductivity</li> </ul>	<ul style="list-style-type: none"> <li>» Drilling</li> <li>» Increased corrosion resistance</li> <li>» Cold and semi-hot forming of steel materials</li> <li>» Cutting of thicker steel sheets</li> <li>» Machining of Al sheets</li> </ul>



## PVD Coating

Name	Material	Microhardness HV 0.05	Friction Coefficient	Thickness [µm]	Max. Application Temperature (°C)	Color	General Characteristic	Application Recommendations
EXXTRAL®-silber	AlTiCrN	3.300 ± 300	0,4	2 – 4	800	silver	<ul style="list-style-type: none"> <li>» High oxidation resistance (800 °C)</li> <li>» High hot hardness</li> <li>» Chemical resistance</li> <li>» Low heat conduction coefficient</li> <li>» Reduced cold welding</li> <li>» Reduced adhesion tendency of Al &amp; non-ferrous metals</li> </ul>	<ul style="list-style-type: none"> <li>» Machining of Al alloys, stainless steel, gray cast iron</li> <li>» Forming of Al sheets</li> </ul>
EXXTRAL®-ultrafine	AlTiN	3.300 ± 300	0,4	2 – 3	800	anthracite	<ul style="list-style-type: none"> <li>» High oxidation resistance (800 °C)</li> <li>» High hot hardness</li> <li>» Chemical resistance</li> <li>» Low heat conduction coefficient</li> <li>» Particularly smooth, defect-free coating surface</li> </ul>	<ul style="list-style-type: none"> <li>» Milling, drilling and turning with high mechanical and thermal loads (max. 800 °C)</li> </ul>
MoX2®	MoS2	< 500	0,1	1	400	anthracite	<ul style="list-style-type: none"> <li>» Can be combined with any PVD or CVD hard coating to be used</li> <li>» Suitable substrate hardness required</li> <li>» Reduction of adhesion and abrasion effects</li> <li>» Reduction of lubricants</li> </ul>	<ul style="list-style-type: none"> <li>» Better chip removal</li> <li>» Less built-up edge formation</li> <li>» Lower adhesion and abrasion effects</li> <li>» Forming and stamping of stainless steel, non-ferrous metals and Al alloys</li> <li>» Self-lubrication support during lubricant degradation</li> </ul>
SISTRAL®	AlTiN based (nanostructured)	2.500 ± 300	0,7	1 – 4	900	anthracite	<ul style="list-style-type: none"> <li>» Very high oxidation resistance</li> <li>» High hot hardness</li> <li>» Chemical resistance</li> <li>» Low tendency to crack formation</li> <li>» Low coefficient of thermal conductivity</li> <li>» High wear resistance</li> </ul>	<ul style="list-style-type: none"> <li>» High performance machining of very abrasive or hard materials (steel &gt; 54 HRC) in dry high-speed operation</li> <li>» Punching of VA grades</li> </ul>
SISTRAL®-plus	AlTiN based (nanostructured)	2.800 ± 300	0,7-0,8	2 – 4	900	petrol	<ul style="list-style-type: none"> <li>» Very high oxidation resistance</li> <li>» High hot hardness</li> <li>» Chemical resistance</li> <li>» Low tendency to crack</li> <li>» Low coefficient of thermal conductivity</li> <li>» High wear resistance</li> </ul>	<ul style="list-style-type: none"> <li>» Dry hard cutting</li> <li>» Milling of workpieces with up to 66 HRC</li> </ul>
SISTRAL®-gold	AlTiN basiert (nanostructured)	3.000 ± 500	0,6	1 – 4	900	gold	<ul style="list-style-type: none"> <li>» High hot hardness</li> <li>» High wear resistance</li> <li>» Easy wear indication</li> <li>» Low tendency to welding</li> </ul>	<ul style="list-style-type: none"> <li>» High performance machining of difficult machinable materials</li> <li>» Like VA steel, titanium or Inconel</li> </ul>



Name	Material	Microhardness HV 0.05	Friction Coefficient	Thickness [µm]	Max. Application Temperature (°C)	Color	General Characteristic	Application Recommendations
SISTRAL® ultrafine	AlTiN (nanostructured)	2.500 ± 300		2 – 3	900	anthracite blue	<ul style="list-style-type: none"> <li>» Very high oxidation resistance</li> <li>» Very high wear resistance</li> <li>» High hot hardness</li> <li>» Particularly smooth, defect-free coating surface</li> </ul>	<ul style="list-style-type: none"> <li>» Hard, dry and high performance machining</li> <li>» Drilling, turning, sawing</li> </ul>
SUBLIME®	AlCrN/ AlTiN based	3.300 ± 200	0,7 – 0,8	2 – 4 ± 1	1.100	grey	<ul style="list-style-type: none"> <li>» Very high hot hardness</li> <li>» Very high oxidation resistance</li> </ul>	<ul style="list-style-type: none"> <li>» Gear cutting - dry machining</li> <li>» Gear cutting - wet machining</li> </ul>
SUCASLIDE®	a-C : Me	1.000 – 1.200	0,05 – 0,1	1,5 – 2,5	400	black	<ul style="list-style-type: none"> <li>» Good adhesion</li> <li>» High hardness</li> <li>» Sufficient coating thickness</li> <li>» Low coefficient of friction</li> <li>» Very dense and smooth coating structure</li> <li>» Biocompatible</li> </ul>	<ul style="list-style-type: none"> <li>» Forming and cutting tools for non-ferrous metals, especially Al</li> <li>» Injection molding: molding surfaces, slides and ejectors (completely dry machining possible)</li> <li>» Gear wheels, bearings, sealing and guide elements</li> <li>» paper knives, industrial blades</li> <li>» food and medical technology</li> </ul>
SUPRAL	TiAlCN	3.500 ± 500	< 0,5	2 – 5	800	black	<ul style="list-style-type: none"> <li>» High oxidation resistance</li> <li>» Chemical resistance</li> <li>» Low coefficient of thermal conduction</li> <li>» Low coefficient of friction</li> <li>» High hot hardness</li> </ul>	<ul style="list-style-type: none"> <li>» drilling of steel up to 45HRC</li> <li>» carbide, cermet and HSS tools</li> <li>» cast iron machining</li> <li>» High speed machining</li> <li>» Semi-dry, dry machining</li> <li>» Punching of steel sheets</li> </ul>
TiCN	TiCN (multilayer)	3.500 ± 500	0,2	1 – 4	400	blue-grey	<ul style="list-style-type: none"> <li>» Very high hardness</li> <li>» High adhesive strength</li> <li>» Good wear resistance</li> <li>» Improved toughness</li> <li>» Low coefficient of friction</li> <li>» High thermal conductivity</li> </ul>	<ul style="list-style-type: none"> <li>» Milling, turning, drilling and cutting tools for high and low alloy steels</li> <li>» High feed and cutting speeds</li> <li>» HSS milling cutters (cooled steel machining)</li> <li>» Drawing, punching, pressing and forming tools for high-alloy and low-alloy steels</li> <li>» Cold forming steel and stainless steel</li> </ul>
TiCN ultrafine	TiCN (multilayer)	3.500 ± 500		2 – 3	400	anthracite blue	<ul style="list-style-type: none"> <li>» Very high hardness</li> <li>» High adhesive strength</li> <li>» Good wear resistance</li> <li>» Improved toughness</li> <li>» High thermal conductivity</li> <li>» Particularly smooth, defect-free coating surface</li> </ul>	<ul style="list-style-type: none"> <li>» Milling, turning, drilling and cutting of high - and low-alloy steels (max. 400 °C)</li> <li>» Forming tools: reduced surface roughness, excellent sliding behavior, low use of lubricants</li> </ul>

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TIGRAL®	AlCrTiN	3.300 ± 300	0,6	3 – 5	900	dark gray	<ul style="list-style-type: none"> <li>» High hot hardness</li> <li>» Oxidation resistance</li> <li>» Abrasion resistance</li> <li>» Resistance to microcracks</li> </ul>	<ul style="list-style-type: none"> <li>» Wear protection of Al die casting molds</li> <li>» Dry machining</li> <li>» Reaming of medium, higher alloyed steels</li> <li>» Hot forming of sheet metal or solid material</li> <li>» Cold forming of sheet metal (low cold welding with steel)</li> </ul>
TiN	TiN	2.300 ± 300	0,6	1 – 4	500	gold	<ul style="list-style-type: none"> <li>» All-round high performance coating</li> </ul>	<ul style="list-style-type: none"> <li>» Machining, cutting of ferrous metals and steel materials</li> <li>» Hobbing, drilling, tapping</li> <li>» Drawing, punching, pressing, forming</li> <li>» Injection molding (demolding, wear protection)</li> <li>» Food industry, medical technology</li> </ul>
TiN ultrafine	TiN	2.800 ± 150		2 – 4	500	gold	<ul style="list-style-type: none"> <li>» All-round high-performance coating</li> <li>» Particularly smooth, defect-free coating surface</li> </ul>	<ul style="list-style-type: none"> <li>» Demolding improvement of injection molded parts</li> <li>» Forming technology</li> </ul>
TOPMATIC®	TiAlN	2.800 ± 300	0,6	5 – 10	700	aubergine	<ul style="list-style-type: none"> <li>» Adhesion and coating thickness similar to CVD</li> <li>» For uniform abrasive wear</li> <li>» Enormous wear cushion</li> </ul>	<ul style="list-style-type: none"> <li>» Forming and cutting of sheet steel</li> <li>» Cold forming</li> </ul>
VARIANTIC®	TiAlCN	3.500 ± 500	0,2	2 – 4	800	old pink	<ul style="list-style-type: none"> <li>» Significant friction reduction</li> <li>» Multilayer structure</li> <li>» High wear resistance</li> <li>» Tough, hard and resistant up to 800 °C</li> </ul>	<ul style="list-style-type: none"> <li>» Reaming and milling of steels</li> <li>» Punching/forming of sheet steel</li> <li>» Cold forming at high compressive loads</li> </ul>
ZrCN	ZrCN	3.100 ± 300	0,5	1 – 4	600	brownish silver	<ul style="list-style-type: none"> <li>» Wear resistance</li> <li>» High hardness</li> <li>» Excellent corrosion resistance</li> <li>» Low coefficient of friction</li> <li>» Good adhesion of the coating</li> </ul>	<ul style="list-style-type: none"> <li>» Machining of Al alloys and non-ferrous metals</li> <li>» Stamping/forming of light metals (if cold overlay welding with TiN)</li> <li>» Corrosion protection with simultaneous high abrasion resistance</li> </ul>
ZrN	ZrN	2.800 ± 300	0,5	1 – 4	600	light yellow	<ul style="list-style-type: none"> <li>» Wear resistance</li> <li>» High hardness</li> <li>» Excellent corrosion resistance</li> <li>» Biocompatible</li> </ul>	<ul style="list-style-type: none"> <li>» High performance machining</li> <li>» Hobbing, dry broaching, fine blanking, hot pressing</li> <li>» Al die casting</li> <li>» Abrasive and adhesive wear</li> </ul>



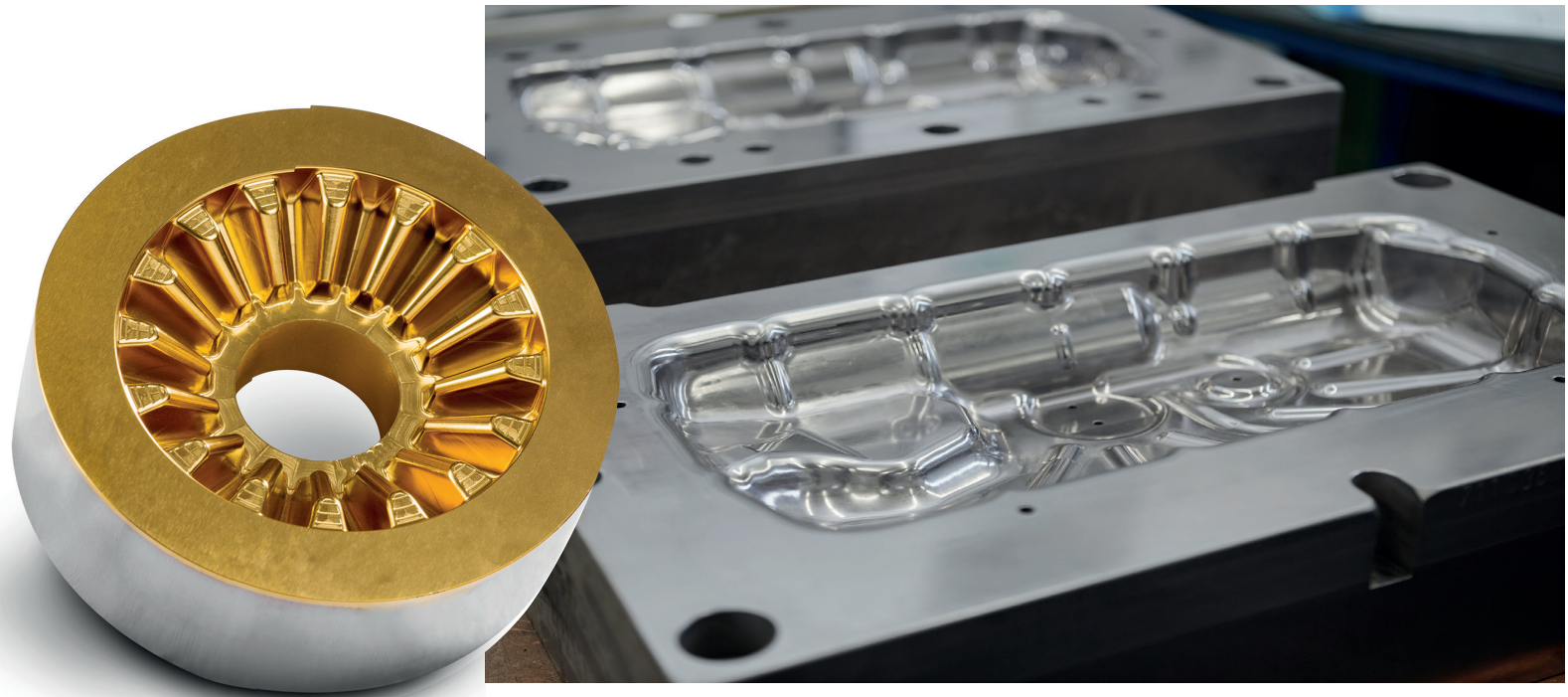
## PVD = Physical Vapour Deposition

is a process for the synthesis of hard coatings based on ionized metal vapor at process temperatures of approx. 450 °C. The most common methods used by the voestalpine eifeler Group are cathodic sputtering (magnetron sputtering) and cathodic arc evaporation (cathodic arc).

Sputtering involves bombarding a metal target with energy-landed noble gas ions to enable film growth. The arc process, in contrast, uses an arc discharge in a vacuum to vaporize the respective starting metal. To produce the ceramic (nitride) hard coatings, specific reactive gases (e.g. nitrogen) are also added, resulting in the deposition of a micrometer-thin hard coating layer with the respective chemical composition on the tool to be coated. For reasons of purity, all PVD processes are carried out under vacuum conditions.

## Duplexbehandlung = Plasma Nitriding + PVD Coating System in One Process

The PVD duplex treatment comprises a nitriding of the tool surface based on a specifically adapted plasma process, on which the immediately subsequent deposition of a PVD layer takes place without interrupting the vacuum process. This combined procedure (2-steps in one process) leads to a defined increase in the surface strength and load-bearing capacity of the tool / component with subsequent targeted coating application.



**Contact our experts for more information:**

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