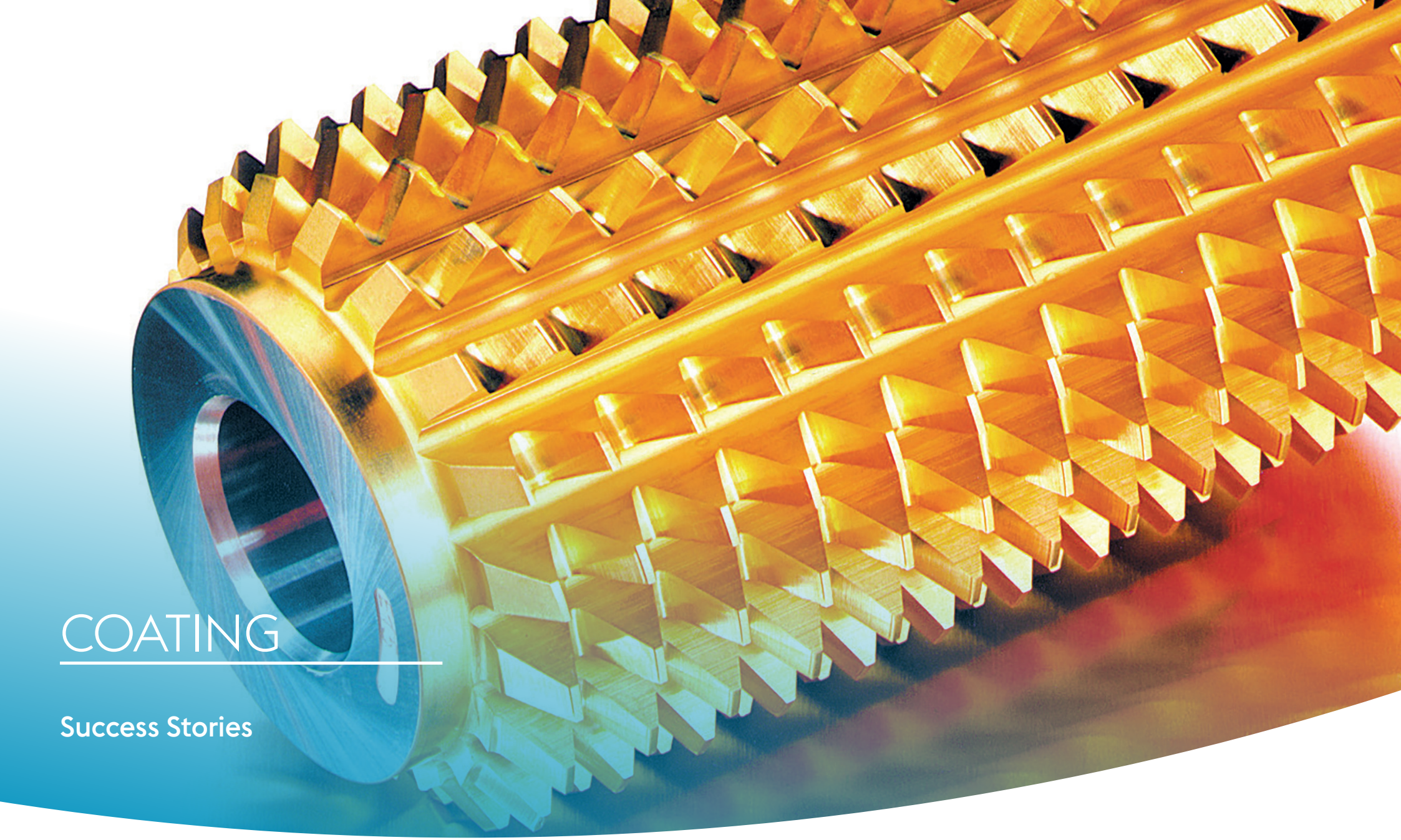

COATING

Success Stories

voestalpine High Performance Metals International GmbH
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ONE STEP AHEAD.

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	» Extremely high hardness » High adhesive strength	» Drawing, punching, pressing and forming tools: Machining of ferrous metals and sheet steel (especially stainless steels)
CVD TiC/TiN	TiC/TiN	2.700 ± 300	0,6	~1000	8 – 10	500	gold	» Very high hardness » High adhesive strength	» Indexable inserts in machining or roughing of not too strong steels » Drawing, punching, pressing and forming tools for aluminum clad or galvanized galvanized sheets
	TiN/TiC	3.000 ± 300	0,2	~1000	max. 10	450	grey metallic	» Very high hardness » High adhesive strength » Higher hardness compared to TiC/TiN	» Drawing, punching, pressing and forming tools: Processing of ferrous metals and steel plates (especially for thicker plates with high surface pressures)

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	» Maximum wear resistance due to high coating hardness » Low coefficients of friction and reduced adhesions » High tool performance and running performance	» Cutting of non-ferrous metals » Cutting of non-ferrous metals » Cold forming » Plastic injection molding and components
CARBON-X®-AL	a-C : H	2.400 ± 400	0,05 – 0,10	3 – 4	325	dark grey	» Maximum wear resistance due to high coating hardness » Low coefficients of friction and reduced adhesions » High tool performance and running performance	» Forming of aluminum
CrN	CrN	2000 ± 600	0,3 – 0,4	1 – 6	600	slate gray	» High hardness and adhesion » Very good chemical resistance » Low coefficient of friction against steel » High air temperature resistance » Low residual stress » Thicker layers possible	» Metal forming » Plastics processing (improved demolding, corrosive and abrasive wear) » Aluminum and magnesium die casting » Machining of non-ferrous metals
CrCN	CrCN	2.300 ± 200	0,2 – 0,3	2 – 6	600	silver-gray	» Hohe Härte und Haftfestigkeit » Sehr gute chemische Beständigkeit » Geringer Reibungskoeffizient gegen Stahl » Hohe Luft Temperaturbeständigkeit » Niedrige Eigenspannung » Dickere Schichten möglich	» Metal forming » Plastics processing (improved demolding, corrosive and abrasive wear) » Aluminum and magnesium die casting » Machining of non-ferrous metals
CrN Multilage	CrN	2000 ± 200	0,3 – 0,4	2 – 6	600	silver-gray	» High hardness and adhesion » Very good chemical resistance » High air temperature resistance » Significantly improved corrosion resistance due to multilayer layer structure (e.g. plastic injection molding: processing of PVC or flame retardant)	» Plastics processing (improved demolding, corrosive and abrasive wear) » Drawing, stamping, pressing and forming dies for the processing of non-ferrous metals (especially Ti, Cu) » Mg die casting (improved demolding)
CROSAL®-plus	AlCrN	3.200 ± 300	0,45	2 – 5	1.100	slate gray	» High oxidation resistance » Excellent hot hardness » Excellent adhesion	» Machining and high performance machining » Gear cutting, dry broaching » Stamping, forming, fine blanking » Hot pressing » Aluminum die casting

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	» Highest hardness and abrasion resistance for forming » Tough layer structure » Enormous wear resistance	» Cold forming » Cutting of high-strength sheet metal » Cold forming processes with high surface pressure » Drawing, punching, pressing & forming tools for the processing of high-alloy Cr-Ni materials
Duplex-VARIANTIC®	Duplex TiAlCN	3.500 ± 500		2 – 4	800	old pink	» Significant friction reduction » Multilayer structure » High wear resistance	» Grinding and milling of steels » Sheet steel and cold solid forming » Especially for high pressure loads in the tool
Duplex-VARIANTIC®-1000	Duplex TiAlCN	4.000 ± 200	0,6 – 0,7	ca. 9	800	dark red gold	» High layer adhesion excellent abrasive wear protection	» Drawing, pressing and forming tools for the processing of high-strength steels
Duplex-VARIANTIC®-1400	Duplex TiAlCN	3.000 ± 200	0,05 – 0,15	5 – 7	800	gold	» Excellent resistance against abrasive and adhesive wear » Very good adhesion	» Cold forming of steel grades from 1,000 to 1,400MPa » Punching/cutting of steel grades ≥1,000MPa
EXXTRAL®	AlTiN Monolayer	3.300 ± 300	0,7	2 – 5	800	anthracite	» High oxidation resistance (800 °C) » High hot hardness » Chemical resistance » Low heat conduction coefficient	» Milling, drilling, and turning. » No need for cooling lubricant » Forming technology
EXXTRAL®-plus	AlTiN	3.300 ± 300	0,7	2 – 5	800	anthracite	» Particularly smooth and dense » High oxidation resistance (800°C) » High hot hardness » Increased toughness » Chemical resistance » Low coefficient of thermal conductivit	» Drilling » Increased corrosion resistance » Cold and semi-hot forming of steel materials » Cutting of thicker steel sheets » Machining of Al sheets

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	» High oxidation resistance (800 °C) » High hot hardness » Chemical resistance » Low heat conduction coefficient » Reduced cold welding » Reduced adhesion tendency of Al & non-ferrous metals	» Machining of Al alloys, stainless steel, gray cast iron » Forming of Al sheets
EXXTRAL®-ultrafine	AlTiN	3.300 ± 300	0,4	2 – 3	800	anthracite	» High oxidation resistance (800 °C) » High hot hardness » Chemical resistance » Low heat conduction coefficient » Particularly smooth, defect-free coating surface	» Milling, drilling and turning with high mechanical and thermal loads (max. 800 °C)
MoX2®	MoS2	< 500	0,1	1	400	anthracite	» Can be combined with any PVD or CVD hard coating to be used » Suitable substrate hardness required » Reduction of adhesion and abrasion effects abrasion effects » Reduction of lubricants	» Better chip removal » Less built-up edge formation » Lower adhesion and abrasion effects » Forming and stamping of stainless steel, non-ferrous metals and Al alloys » Self-lubrication support during lubricant degradation
SISTRAL®	AlTiN based (nanostructured)	2.500 ± 300	0,7	1 – 4	900	anthracite	» Very high oxidation resistance » High hot hardness » Chemical resistance » Low tendency to crack formation » Low coefficient of thermal conductivity » High wear resistance	» High performance machining of very abrasive or hard materials (steel > 54 HRC) in dry high-speed operation » Punching of VA grades
SISTRAL®-plus	AlTiN based (nanostructured)	2.800 ± 300	0,7-0,8	2 – 4	900	petrol	» Very high oxidation resistance » High hot hardness » Chemical resistance » Low tendency to crack » Low coefficient of thermal conductivity » High wear resistance	» Dry hard cutting » Milling of workpieces with up to 66 HRc
SISTRAL®-gold	AlTiN basiert (nanostructured)	3.000 ± 500	0,6	1 – 4	900	gold	» High hot hardness » High wear resistance » Easy wear indication » Low tendency to welding	» High performance machining of difficult machinable materials » Like VA steel, titanium or Inconel

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	» Very high oxidation resistance » Very high wear resistance » High hot hardness » Particularly smooth, defect-free coating surface	» Hard, dry and high performance machining » Drilling, turning, sawing
SUBLIME®	AlCrN/ AlTiN based	3.300 ± 200	0,7 – 0,8	2 – 4 ± 1	1.100	grey	» Very high hot hardness » Very high oxidation resistance	» Gear cutting - dry machining » Gear cutting - wet machining
SUCASLIDE®	a-C : Me	1.000 – 1.200	0,05 – 0,1	1,5 – 2,5	400	black	» Good adhesion » High hardness » Sufficient coating thickness » Low coefficient of friction » Very dense and smooth coating structure » Biocompatible	» Forming and cutting tools for non-ferrous metals, especially Al » Injection molding: molding surfaces, slides and ejectors (completely dry machining possible) » Gear wheels, bearings, sealing and guide elements » paper knives, industrial blades » food and medical technology
SUPRAL	TiAlCN	3.500 ± 500	< 0,5	2 – 5	800	black	» High oxidation resistance » Chemical resistance » Low coefficient of thermal conduction » Low coefficient of friction » High hot hardness	» drilling of steel up to 45HRC » carbide, cermet and HSS tools » cast iron machining » High speed machining » Semi-dry, dry machining » Punching of steel sheets
TiCN	TiCN (multilayer)	3.500 ± 500	0,2	1 – 4	400	blue-grey	» Very high hardness » High adhesive strength » Good wear resistance » Improved toughness » Low coefficient of friction » High thermal conductivity	» Milling, turning, drilling and cutting tools for high and low alloy steels » High feed and cutting speeds » HSS milling cutters (cooled steel machining) » Drawing, punching, pressing and forming tools for high-alloy and low-alloy steels » Cold forming steel and stainless stainless steel
TiCN ultrafine	TiCN (multilayer)	3.500 ± 500		2 – 3	400	anthracite blue	» Very high hardness » High adhesive strength » Good wear resistance » Improved toughness » High thermal conductivity » Particularly smooth, defect-free coating surface	» Milling, turning, drilling and cutting of high - and low-alloy steels (max. 400 °C) » Forming tools: reduced surface roughness, excellent sliding behavior, low use of lubricants

PVD Coating

Name	Material	Microhardness HV 0.05	Friction Coefficient	Thickness [µm]	Max. Application Temperature (°C)	Color	General Characteristic	Application Recommendations
TIGRAL®	AlCrTiN	3.300 ± 300	0,6	3 – 5	900	dark gray	» High hot hardness » Oxidation resistance » Abrasion resistance » Resistance to microcracks	» Wear protection of Al die casting molds » Dry machining » Reaming of medium, higher alloyed steels » Hot forming of sheet metal or solid material » Cold forming of sheet metal (low cold welding with steel)
TiN	TiN	2.300 ± 300	0,6	1 – 4	500	gold	» All-round high performance coating	» Machining, cutting of ferrous metals and steel materials » Hobbing, drilling, tapping » Drawing, punching, pressing, forming » Injection molding (demolding, wear protection) » Food industry, medical technology
TiN ultrafine	TiN	2.800 ± 150		2 – 4	500	gold	» All-round high-performance coating » Particularly smooth, defect-free coating surface	» Demolding improvement of injection molded parts » Forming technology
TOPMATIC®	TiAlN	2.800 ± 300	0,6	5 – 10	700	aubergine	» Adhesion and coating thickness similar to CVD » For uniform abrasive wear » Enormous wear cushion	» Forming and cutting of sheet steel » Cold forming
VARIANTIC®	TiAlCN	3.500 ± 500	0,2	2 – 4	800	old pink	» Significant friction reduction » Multilayer structure » High wear resistance » Tough, hard and resistant up to 800 °C	» Reaming and milling of steels » Punching/forming of sheet steel » Cold forming at high compressive loads
ZrCN	ZrCN	3.100 ± 300	0,5	1 – 4	600	brownish silver	» Wear resistance » High hardness » Excellent corrosion resistance » Low coefficient of friction » Good adhesion of the coating	» Machining of Al alloys and non-ferrous metals » Stamping/forming of light metals (if cold overlay welding with TiN) » Corrosion protection with simultaneous high abrasion resistance
ZrN	ZrN	2.800 ± 300	0,5	1 – 4	600	light yellow	» Wear resistance » High hardness » Excellent corrosion resistance » Biocompatible	» High performance machining » Hobbing, dry broaching, fine blanking, hot pressing » Al die casting » Abrasive and adhesive wear

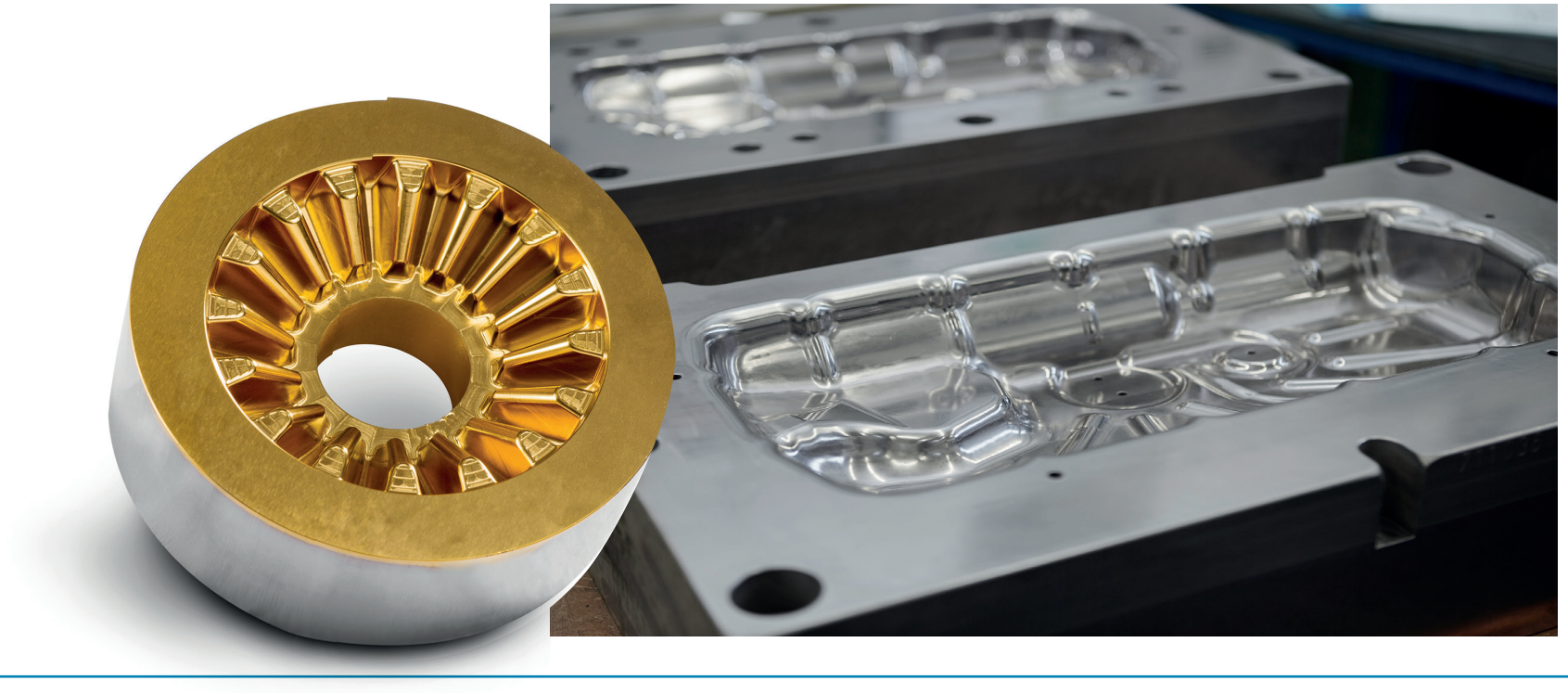
PVD = Physical Vapour Deposition

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.



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