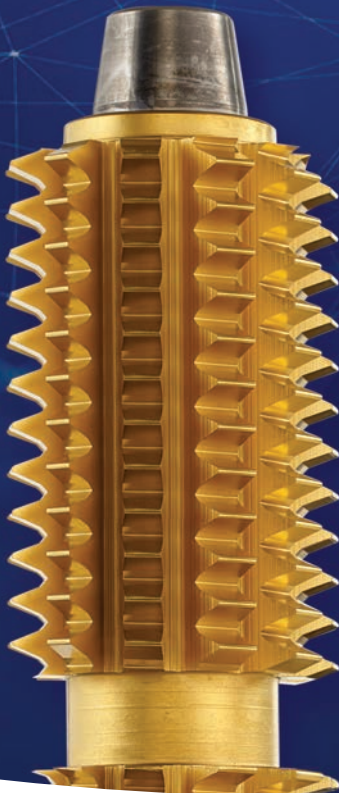


PVD COATING SOLUTIONS

For increased tooling performance



OUR PVD COATING SERVICE

A German based PVD coating technology from voestalpine eifeler Coating GmbH helps to support our Indian customer in various application to increase the tooling performance.

To achieve best performance in various applications it is a must to choose the suitable Tool Steel & PVD coating based on the application & failure pattern. The high performance PVD coating improves the tool life by protecting the tool against abrasive wear and adhesive wear e.g. a reduced coefficient of friction. Oxidation resistant of PVD coating also plays a major role in achieving a good tool life.

BENEFITS

- Improved part quality
- Higher productivity
- Less down time
- Lower tooling costs
- Longer tooling life
- Reduced lubricant consumption

FEATURES

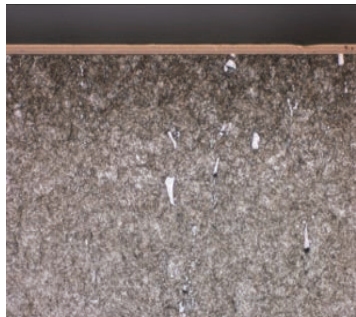
- High hardness
- Wear resistance
- Toughness
- Low coefficient of friction
- Galling resistance
- Corrosion resistance
- High temperature stability



voestalpine eifeler Duplex Coating

The combination of plasma nitriding and a subsequent deposition of PVD coating in a non-interrupted process is called voestalpine eifeler duplex coating.

With Plasma nitriding, the surface hardness of the steel substrate is increased. Thus the ability to withstand pressure loads is significantly increased.



Nitriding Cross Section

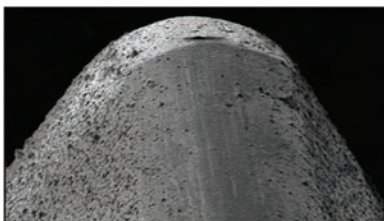
ADVANTAGES

- No compound layer in steel
- Increased surface hardness
- Polished surface is preserved
- Excellent adhesive strength
- No change in dimension
- Increased load capacity
- Low plasma nitriding temperature (<480°C)

SPCS ARC TECHNOLOGY - ULTRAFINE COATING

Application with critical requirement on the surface finish will benefit from Ultrafine coating with its unrivaled properties against standard arc coating process. In applications like Cutting, Micro-cutting, Surgical Instrument, Ultrafine coating also shown to provide significant improvement.

COMPARISON BETWEEN STANDARD ARC COATING



STANDARD ARC COATING

Some droplets
Suitable for most applications
But may require post-polishing



SPCS ULTRAFINE COATING

Smoother & denser coating
Enhanced adhesion
Advantageous for selected applications

COATING OVERVIEW

Name of Coating	Material	Micro hardness HV0.05	Coeff. of friction against steel	Coating thickness [µm]	Max. temp. of operation	Colour	General characteristic
TiN	TiN	2300±200	0.6	2-4	500°C	Gold	Allround coating, bio-compatible
TiCN	TiCN (Multilayer)	3500±500	0.2	2-4	400°C	Blue-grey	High hardness, excellent wear resistance, improved toughness
CrN / CrCN	Cr(C)N (Multilayer)	2000±200 (2300±200)	0.2 - 0.3	2-6	600°C	Silver-grey	Low stress, high adhesive force, very high resistance against corrosion
EXXTRAL®	AlTiN	3300±300	0.7	2-5	800°C	Anthracite	High hardness, high oxidation resistance, low coeff. of friction
SISTRAL®	AlTiN (Nano-structured)	3400±500	0.7	2-5	900°C	Anthracite	High oxidation resistance; high warm hardness, high wear resistance
ZrN / ZrCN	Zr(C)N (Multilayer)	2800±200 (3100±300)	0.5	1-4	600°C	Yellow brown-silver	Low tendency for cold welding, excellent corrosion resistance
CROSAL® PLUS	AlCrN (Based)	3300±300	0.4	2-5	1100°C	Slate-grey	Extremely high oxidation resistance, high warm hardness, high wear resistance
SUBLIME®	AlCrN (Based)	3300 ± 200	0.7-0.8	2.5	1100°C	Grey	Extremely very high oxidation, excellent high temperature wear resistance
TIGRAL	AlCrTiN (Nanolayer)	3300±300	0.6	4-8	900°C	Grey	High oxidation resistance, high warm-hardness, high wear resistance
TOPMATIC	TiAlN	2800±200	0.4	5-10	800°C	Aubergine	Very high toughness, good oxidation resistance, high wear resistance
VARIANTIC®	TiAlCN (Multilayer)	3500±500	0.2	4-5	800°C	Old-rose	Low friction, high oxidation resistance
VARIANTIC® 1000	TiAlCN (Multilayer)	4000±200	0.05-0.15	8-10	800°C	Old-rose	Low coefficient of friction, excellent abrasive and adhesive wear resistance
VARIANTIC® 1400	Al(Cr-Ti) N (Based)	3000±200	0.6-0.7	5-7	800°C	Gold	Excellent resistance against abrasive and adhesive wear in cold forming of galvanised sheet steel with tensile strength upto 1400 MPa
DUMATIC	TiN/TiC (Multilayer)	3700±200	0.3	3-5	400°C	Silver-grey	Very high hardness, very high adhesive force, low coeff. of friction

COLD WORK APPLICATION

For cold work applications like forming, fine blanking and powder compacting etc., the typical failures on the surface are abrasive wear, adhesive wear, galling and friction.

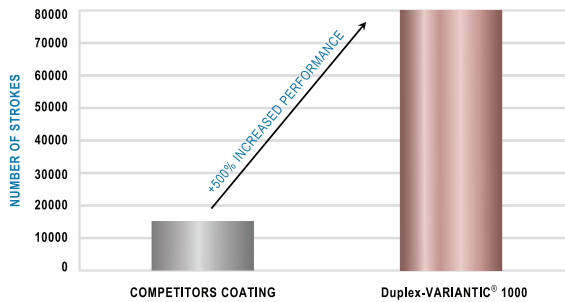
Failure Mechanisms	Wear	Chipping	Plastic deformation	Cracking/total failure	Galling
Primary Solution	PVD Coating	Tool Steel + HT	Tool Steel + HT	Tool Steel + HT	PVD Coating
Secondary Solution	Tool Steel + HT	PVD Coating	PVD Coating	PVD Coating	Tool Steel + HT

Note: Above are generic recommendation & solution depending on application, substrate, tool design, surface finish, tool manufacturing conditions.

THE HARDNESS SCALE OF HARD COATING

HV / Vickers	240	300	400	500	600	700	800	940	700 to 1200	1400 to 1800	2000 to 4000	10000
HRC / Rockwell	20	29.4	40.8	49.1	55.2	60.1	64	68	-	-	-	-
Type of steel or process	Soft Steels		Quenched Steels		Hardend Steels			Nitrided	Solid Carbide	PVD	Diamond	

OUR COATING PERFORMANCE RESULT



Tool: Through-punch
Tool Material: 1.2379 (58 HRC)
Workpiece: DP800 with 3.2 mm plate thickness
Lubricant: Oil-free, water based lubricant

COATING RECOMMENDATION

Coating Recommendation		Sheet Material							
		Standard	Upto 700 Mpa	700 to 1000Mpa	1000 to 1400Mpa	Non Ferrous	Stainless Steel	Aluminium	Zn Plated
Stamping / Cutting / Blanking / Fine Blanking / Piercing / Coining / Knife	TiN	X				X			XX
	TiCN	XX					XXX		
	EXXTRAL	XX	XX	X					XX
	CrCN					XXX		XXX	
	VARIANTIC	XXX	XXX	XXX	XX		XXX		XXX
	CROSAL-plus	XXX	XXX	XX		XX	XXX		
	SUBLIME®	XXX	XXX	XX	XX	XX	XXX		
	TIGRAL	XX	XX	X			XX		
Forming / Bending / Deep Drawing / Roller / Forging / Extrusion / Sintering	TOPMATIC	XX		X					
	Duplex-VARIANTIC	XXX	XXX	XX	X		XXX		XXX
	Duplex-VARIANTIC® 1000	XXX	XXX	XXX	XX		XXX		XXX
	Duplex-VARIANTIC 1400				XXX				
	Duplex CrCN					XXX		XXX	
	Duplex TIGRAL	XX	XX	X			XX		
	Duplex-CROSAL-plus					XX	XX		
	Duplex-SUBLIME®	XX	XX	X	X	XX	XXX		
Duplex TOPMATIC	XX	XX							

XXX - Most Recommended

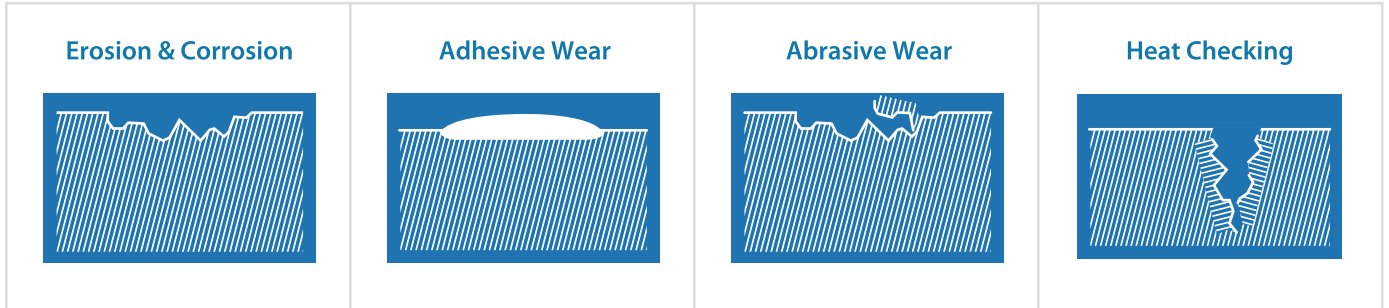
XX - Recommended

X - Can be used

Note: Above are generic recommendation & solution depending on application, substrate, tool design, surface finish, tool manufacturing conditions. Contact Technical Team for suitable recommendations.

HOT WORK APPLICATION

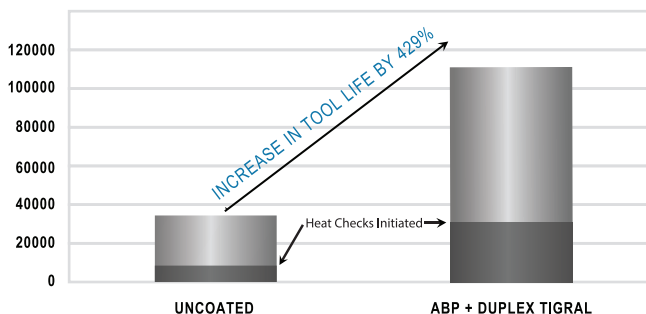
In hot work applications like die-casting, typical surface failures are erosion, soldering, corrosion and thermal fatigue. In die-casting dies, in which cores are surrounded by high-temperature melt. Soldering is always the main problem that causes a lot of failures, for instance cracking due to high ejection force. PVD coating can act as an insulation layer to prevent reaction between the die steel and the casting melt, hence minimizing soldering. In hot forging and extrusion applications, the main surface failure is hot wear. This is a result of hardness decrease under elevated temperatures.



ADDRESS THE PROBLEM WITH RIGHT TECHNICAL SOLUTIONS

MAKE YOUR GOOD CHOICE FOR AL DIE CASTING	TOOL STEEL CHOICE AND HEAT TREATMENT	TAILORED PVD COATING	ABP + PVD COATING
Is responsible for	Thermal conductivity Dimensional stability Toughnesses	Protection against erosion Corrosion resistance High thermal resistance	Heat checking resistance Erosion & corrosion resistance High thermal resistance
Protects against	Cracking / Gross cracking Heat checking Plastic deformation	Abrasive wear Adhesive wear Soldering	Heat checking Abrasive & adhesive wear Soldering

OUR COATING PERFORMANCE RESULTS



PART REJECTION REDUCED FROM 40% TO 6%

- Two Wheeler Swing Arm
- HPDC, Silafont 36, >720 Deg C (Operating Temp)
- Grade 1.2367 (46-48hrc) & Die Size - 850 X 285 X 190 & 850 X 390 X 230



APPLICATION DEMANDS

- High aesthetic
- Reduced casting rejection
- Reduced buffing operation on casting part
- Increased tool longevity

PLASTIC APPLICATION

BENEFIT OF PVD COATING IN PLASTIC APPLICATION

- Protection against abrasive wear
- Protection against sticking of melt
- Improved mould release
- Maintaining the best surface quality of plastic parts
- Preserved mirror polished surface
- Corrosion resistant

Increased tool life, reduction in wastage resulting in low cost per components.

Low maintenance cost & reduced mould maintenance Frequency.

High Productivity due to less machine downtime.



COATING RECOMMENDATION - PLASTIC INJECTION

Thermoplast		TiN	CrN/CrCN	Tigral
Polyolefine	PE, PP, PB	X	XX	XXX
Styrol polymerisate	PS, SB, SAN, ABS, ASA	XX	XX	XXX
Chlorhaltige Polymerisate	PVC		XXX	X
Fluorhaltigs Polymerisate	PTFE, PVDF		XX	XX
Acetalherze	POM	XX	XX	XXX
Polyamide	PA	XXX	XXX	XXX
Lineare Polyster	PC, PBT(B),PET(P)	XXX	XXX	XXX
Polyarylentene	PEEK, PPS,PSU,PES,PPE,PPO	X	XXX	XXX
Polyamide	PI	XXX		X
Celluloseester	CA, CP, CAP	XXX		X
Polyacrylate	PMMA	XXX	XX	X
Polyurethane	TPU		XXX	XX
Wear mechanism	abrasion	XX	XX	XXX
	adhesion	XX	XX	XX
	corrosion		XXX	XX
	demoulding	X	XX	X
	filling behaviour	X	X	XX
Thermoset		TiN	CrN	Tigral
Phenolic	PF	X	X	XXX
Aminoplaste	MF, UF, MP	XX	XXX	XX
Elastomer		TiN	CrN	Tigral
Polyurethane	PUR		XX	
Synthetischer Kautschunk	NBR, EPDM, Si	X	XX	
Flurierte Elastomere	Multipolymer - TPE,FPM	X	XX	

XXX - Strongly Recommended

XX - Recommended

X - Conditionally Recommended

Note: Above are generic recommendation & solution depending on application, substrate, tool design, surface finish, tool manufacturing conditions. Contact Technical Team for suitable recommendations.

CUTTING TOOLS APPLICATION

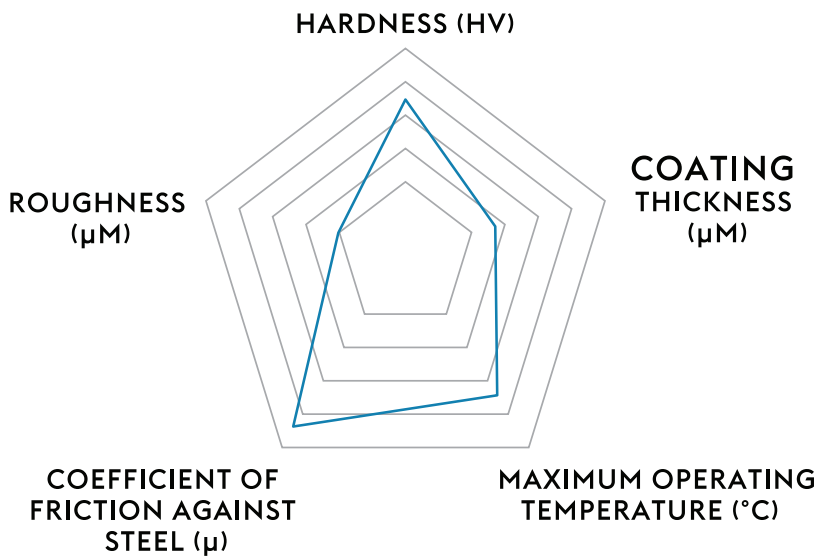
voestalpine HPM India Offers a variety of PVD coatings for the cutting tool industry. From the list of product portfolio, voestalpine eifeler Standard and Advanced coating fulfills the market demand to increase the productivity by working under higher cutting parameters, long lasting tool life, hard machining, dry cutting etc.

voestalpine Ultrafine PVD coating will stand unique in the market that offers very high dense and smooth finish coating with the latest SPCS technology which are most recommended for most of the cutting tool applications.

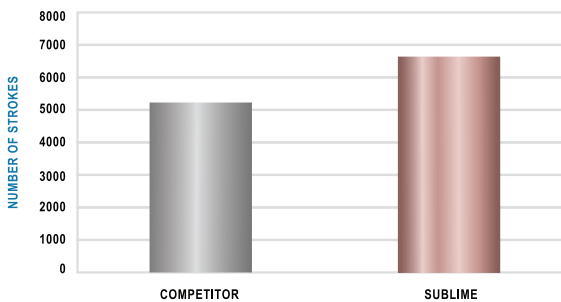
PVD Coating Benefits on Cutting Tools

- Excellent wear resistant
- Advanced oxidation resistant
- Low thermal conductivity
- Low coefficient of friction
- Increased cutting speed & feed Rate

COATING PROPERTIES



SUBLIME CASE STUDY FOR GEAR CUTTING TOOLS



Tool Details-Shank type hob 2M/AAA, Ø90x310mm

Tool Grade-Bohler MC 90

Component grade-16MnCr5, Hardness-160 to 180 BHN

Machine- Felsomat, Dry cutting

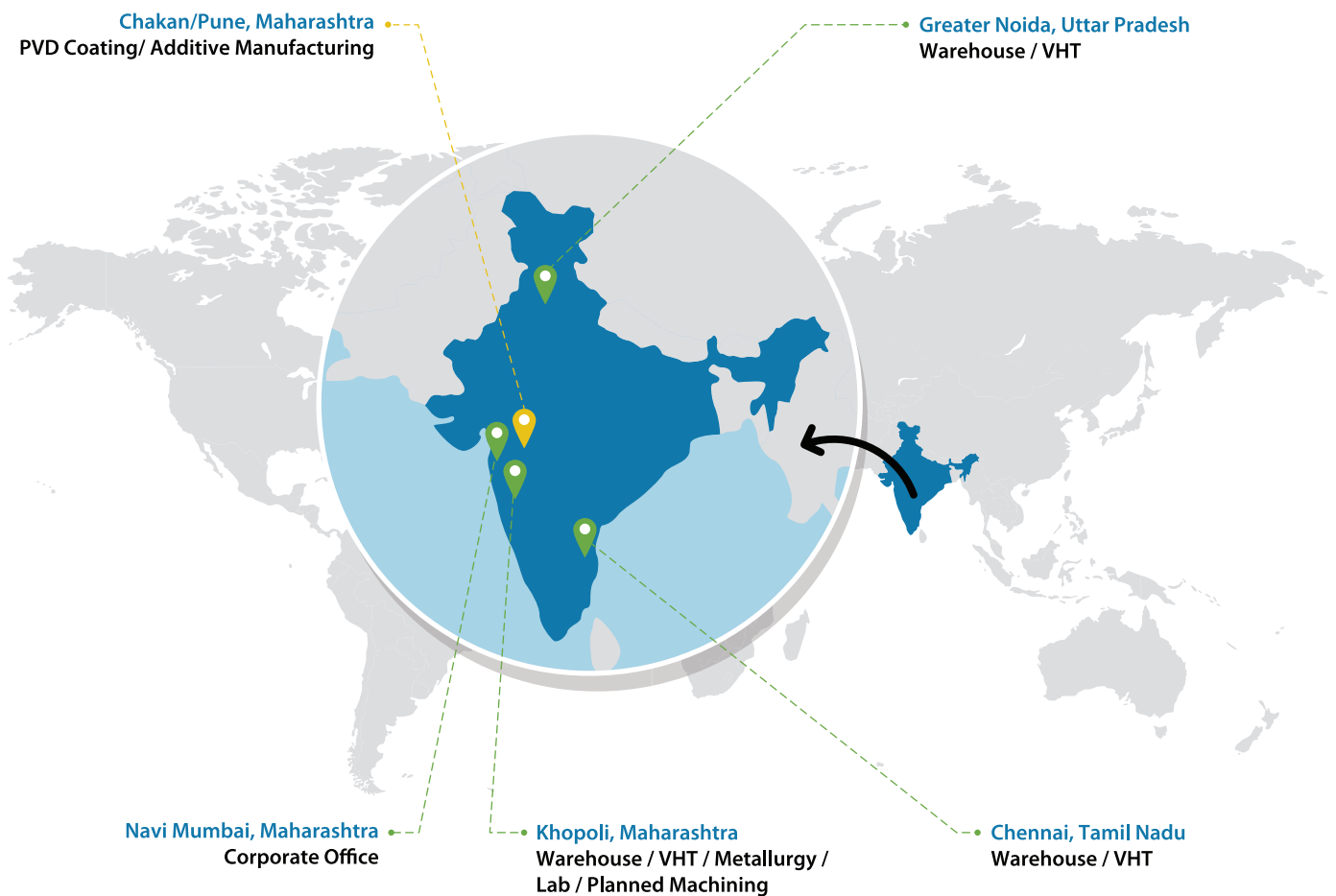
Roughing parameters-Vc 250m/min, Feed-2.7mm/min

Finishing parameters-Vc 400m/min, Feed-2.7mm/min

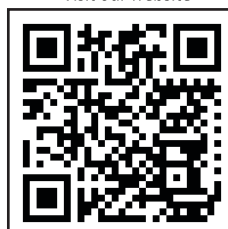
ABOUT voestalpine HIGH PERFORMANCE METALS INDIA

Incorporated in 2008, voestalpine High Performance Metals India Pvt. Ltd. was formerly known as Böhler-Uddeholm India. Pvt. Ltd. It is now a 100% subsidiary of voestalpine High Performance Metals GmbH , which is part of voestalpine AG , a leading technology and capital goods group.

voestalpine High Performance Metals India is the market leader for supplying tool steel & high speed steel of premium quality and providing value added services to automotive, electronics, home appliance, packaging and construction industry sector. To meet the demand of tooling performance, we have a wide range of special steel in our product portfolio which covers cold work, plastic mould, hot work and cutting tool applications along with the Value Added Services like Vacuum Heat Treatment, Cryogenic Process, ABP Process, Components and PVD Coating Services.



Visit our website



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Voestalpine

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