



ASSAB
Coating Technology



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Introduction

ASSAB is the market leader in the Asia Pacific region for supplying tool steels of premium quality and providing value added services to automotive, electronic, home appliance, packaging and construction industry sectors.

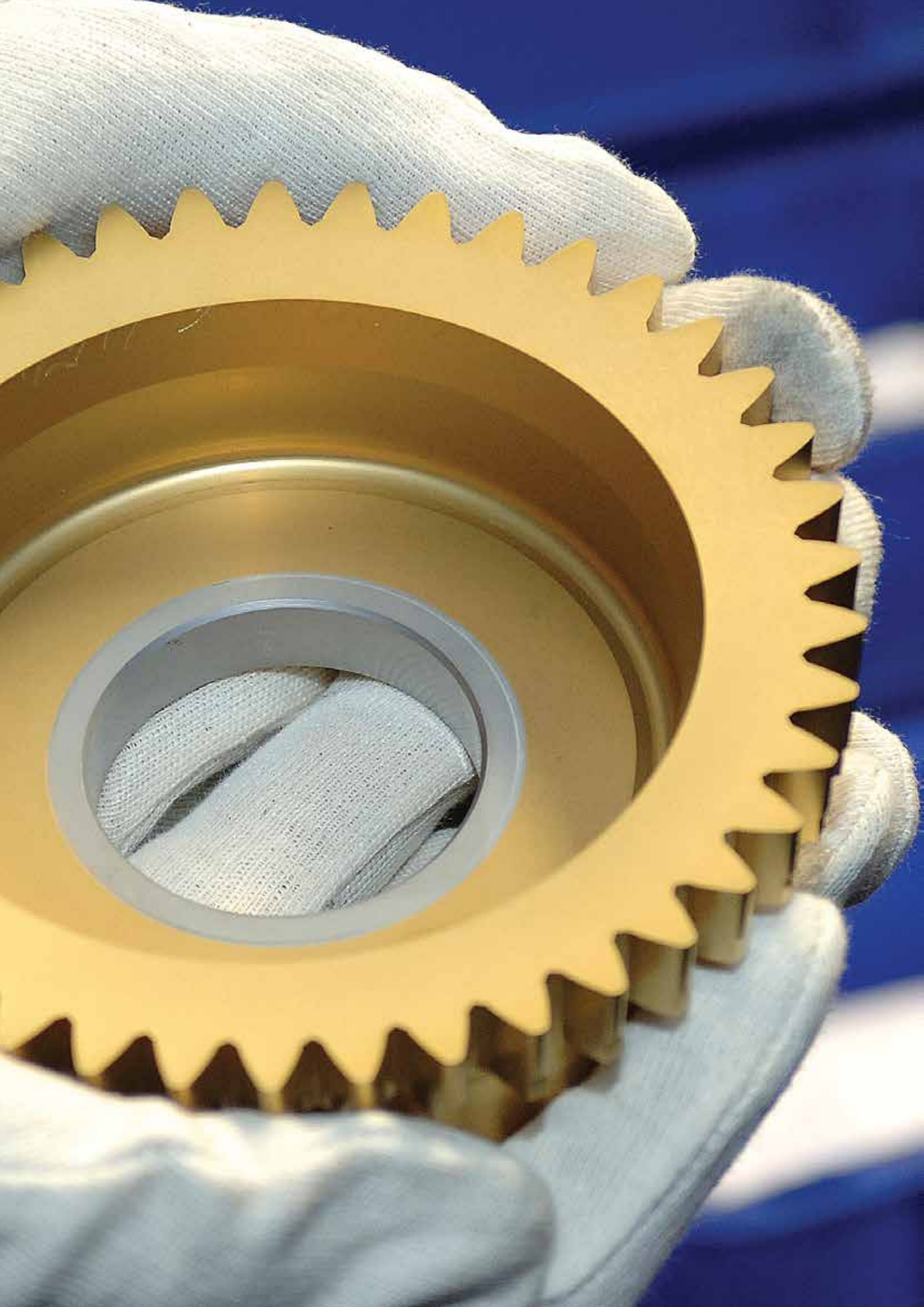
To meet the demand of tooling performance, we have a wide range of tool steels in our product portfolio which covers cold work, plastic mould and hot work applications.

To achieve best performance, it is critical to select a suitable tool steel that is competent in meeting the basic work requirement. This means that the tool steel itself must have an optimal combination of properties like hardness, strength and toughness, and consequently enough resistance to different premature and permanent failures like chipping, plastic deformation and cracking, etc.

There are, however, some normal and acceptable failures like wear that will happen sooner or later depending on the properties of the working die surface. Therefore, one may decide to choose a tool steel which has a higher hardness in order to resist wear, but this results in lower toughness and therefore is not recommended.

Surface treatment, like surface hardening, nitriding, hard coatings, can improve the surface hardness without losing the properties of the substrate. As a result, these types of surface treatments are widely used in advanced tooling technology.

Among these surface treatments, PVD coating is one of the best and most popular technologies to improve surface properties. With tailored coatings, the hardness, corrosion resistance, high temperature resistance and tribological properties can be modified to resist different surface failures.



Surface Failures

Here are the most common surface failure mechanisms from different types of tooling applications.

COLD WORK

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.

The appearance of different surface failure in cold working application



Adhesive wear



Galling



Abrasive wear



Coated Precision Cutting Die

HOT WORK

In hot work applications like die-casting, typical surface failures are erosion, soldering, corrosion and thermal fatigue. It is proven that with a suitable coating which acts as a buffer layer, this can minimise dies from soldering, corrosion and erosion, where the failure mechanism is due to, or partly due to the reaction of the melt, lubricant and tool steel. Surface coating of die casting dies can also help eliminate cracking and chipping if these failures originate from the surface attack.

In hot forging and extrusion applications, the main surface failure is hot wear. This is a result of hardness decrease under elevated temperatures.



Erosion and corrosion

Soldering



Surface failure in die-casting dies

PLASTIC MOULDING

Typical failures on the surface of plastic moulds are abrasive wear, scratch and corrosion, depending on the type of plastic and the additive. Surface failure in plastic moulding can be costly, as the user has to re-polish the moulds regularly to restore the glossy cavity surface.

Coatings like TiN, CrN, TiCN or DLC can protect the surface from different types of surface failures and also improve filling and demoulding.



SPCS TiN-ultrafine coated plastic mould for producing cups

Hard Coating

ASSAB PVD TECHNOLOGY, PRINCIPLE AND EQUIPMENT

ASSAB has adopted the latest PVD technology transferred by our group company Eifeler, a world leading coating company. The unique and patented coating machine, Alpha series, is widely used in the coating industry.

The Alpha Arc Coating System is a system for reactive vacuum coating on substrates (tools or components) with metal-based and electrically conductive layers. The arc process is used to generate the necessary metallic ions and atoms. The evaporator (target) and the recipient (process chamber) are connected to a DC voltage source. The former acts as a cathode and the latter as an anode. The tear-off spark from an auxiliary discharge between an anodic trigger and the cathode is used to ignite the arc. After ignition, arcing occurs between the anode and the target, evaporating and ionising the target material in tiny, microscopic spots.

Permanent magnets on the outside hold the arc on the target surface and cause it to move in a circular, stochastic manner. The generated ions and atoms condense onto the substrates to form chemical bonds with the ionised components of the reactive gases. In this way, the desired coating is formed on the surface of the substrate. The high voltage (bias voltage) connected to the electrically conducting substrate is used to change the ion energy and the basic properties of the coating.

For enhancing layer adhesion, the substrates are mounted on a rotating turntable for cleaning by glow discharge and sputter-cleaning, followed by coating on all sides of the substrates. Heating the substrates indirectly by radiant heating will facilitate the coating process.

Besides the arc coating process, an additional operation Plasma Nitriding can be implemented in Alpha Arc Coating System. A plasma source unit, mounted on the process chamber top, and the anode, at the bottom of the chamber, generates plasma within the chamber. During the process, a nitride layer is thermo-chemically produced under the surface of substrates. When using Arc Coating System with plasma source, the substrates can be plasma nitrided and coated in one single process. This sequence of processes is known as ASSAB Duplex Coating process.

ASSAB also uses sputtering technology on several types of coatings for instance MoS₂ and SUCASLIDE. Sputtering is a physical process whereby atoms are extracted from the target by bombardment with high-energy ions and then changed into gas. Sputtering is usually regarded as sputter deposition, which is considered as one of the vacuum-based PVD coating processes.



Alpha Arc Coating System 900P
Maximum capacity: $\varnothing 750 \times 880$
Maximum load: 850Kg



Arc Coating System 400P
Maximum capacity: $\varnothing 450 \times 485$
Maximum load: 300Kg

ASSAB ADVANCED COATING

ASSAB Advanced Coating is widely used in tooling applications with the following unique characteristics:

- Thin (2 - 10 µm)
- Hard (2000 - 4000 HV)
- Preserving the surface structure
- Superb adhesion to substrate
- Low friction against steel
- Low tendency for cold welding
- Corrosion resistant
- High oxidation resistant

TABLE 1. THE HARDNESS SCALE OF HARD COATING

HV / Vickers	240	300	400	500	600	700	800	940	700 to 1200	1400 to 1800	2000 to 8000	10000
HRC / Rockwell	20	29.8	40.8	49.1	55.2	60.1	64	68	-	-	-	-
Type of steel or process	Soft steels		Quenched steels		Hardened steels				Nitrided	Solid carbide	PVD and CVD coatings	Diamond

ASSAB offers customers a wide range of PVD coatings for different types of applications. For instance, high hardness and abrasion resistance for cold work, thermal and abrasion resistance for hot work, and corrosion and abrasion resistance for plastic moulding. In order to achieve the combined properties, coatings are designed to be in variable layer structures - monolayer, multilayer or nanostructured coatings.

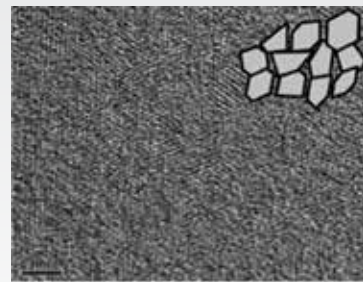
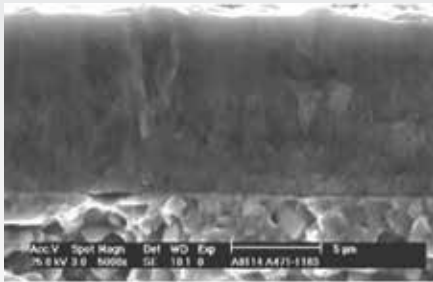
The tailor made nanostructured coating has both extremely high hardness, but also has high toughness that reduces crack sensitivity. Advanced nanocomposited coatings, for example SISTRAL, is characterised by its very high hardness, great ability to protect against wear at high temperature and has an exceptional oxidation stability.

ASSAB DUPLEX COATING

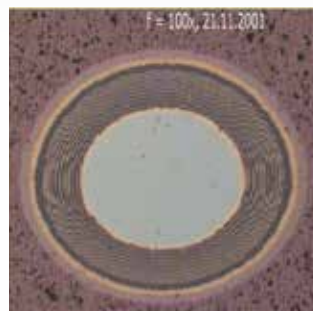
The combination of a plasma nitriding and a subsequent deposition of ASSAB PVD coating in a non-interrupted arc process is called ASSAB Duplex Coating.

With Plasma nitriding, the surface hardness of the substrate is increased, thus considerably improving the performance of a PVD coating. ASSAB Duplex Coating has the following advantages:

- No compound layer in steel
- Increased surface hardness
- Polished surface is preserved
- Excellent adhesive strength
- No change in dimensions
- Increased load capacity
- Low plasma nitriding temperature ($< 480^{\circ}\text{C}$)



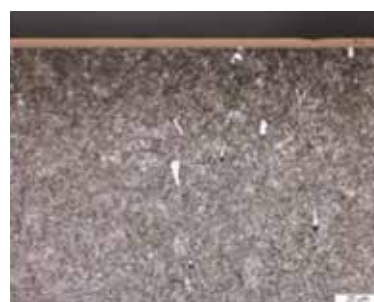
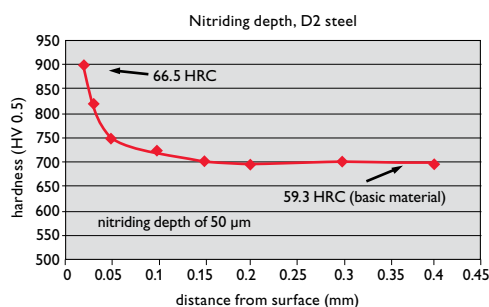
Smooth break zone of SISTRAL without coarse columnar grain (SEM photo, left) resulting from its nanocomposited structure (right).



Multilayered structure of Variantic coating on cemented carbide tool surface, as shown in calotest.

ASSAB Duplex Coating is basically suitable for all kinds of steel substrates. One typical successful application is the forming of high-strength sheet materials where Duplex VARIANTIC or TiCN is regularly used. Combinations with other coatings, except for low temperature coating, are also possible. The following further explains the reasons behind some of the advantages provided by ASSAB Duplex Coating Process:

- Ideal structure of a hardness gradient, i.e., from the tough hard tool core, through a harder and stronger interface, extending to the extremely hard and wear resistant top coating surface.
- With a harder and stronger interface layer support, the outermost extremely hard and brittle ceramic coating is well protected.
- The absorbing ability for pressure loads increases significantly.



The hardness profile along depth after plasma nitriding (left), and the microscope photo of the cross section of a specimen treated by duplex process (right).

SPCS ARC TECHNOLOGY - ULTRAFINE COATING

Filtered arc technology is a method to provide precision tools, components in the aircraft industry and increasingly medical devices and implants with coatings that are extremely high in smoothness and density. It was developed shortly after the introduction of the arc technology for industrial coatings. However, significant costs and long delivery times made it barely economically viable for many coaters and users.

With the SPCS arc technology developed at Eifeler, layers can be deposited with surface quality and density comparable to those of the filtered arc but without its drawbacks. Coating deposited by using SPCS arc technology are labeled as ultrafine coating, like TiN-ultrafine, TiCN-ultrafine, etc. Plastic application with critical requirement on the surface finishing will benefit from ultrafine coating with its unrivalled properties against standard arc coating process. In applications like cutting, micro-cutting, surgical instrument, ultrafine coating also shows to provide significant improvement.

COMPARISON BETWEEN STANDARD ARC COATING AND SPCS ULTRAFINE COATING



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



SPCS ULTRAFINE COATING
 Smoother and denser coating
 Enhanced adhesion
 Advantageous for selected applications



ASSAB SPUTTERING TECHNOLOGY

A typical example of ASSAB Sputtering Technology is MoS₂ coating which is a solid lubricant and frequently applied as overlay on hard coatings. The long lasting layer provides a significant improvement in the frictional resistance. It increases the overall service life and is effective against adhesive wear. The main applications of MoS₂ coating are:

- Cutting: Main focus on tapping application by TiN- or TiCN- hard coatings.
- Forming: For drawing, stamping, pressing and forming tools where the application of cooling lubricants should be economised.

To improve the friction condition, it is also possible to deposit on parts and tools without a prior hard coating.

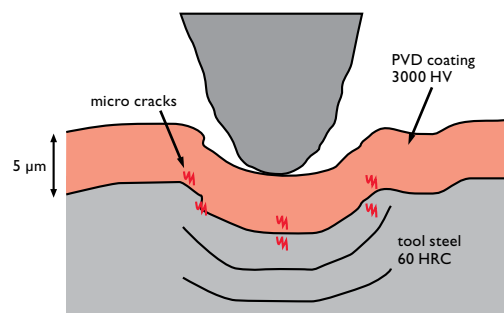
Another well known sputter coating is Diamond Like Coating (DLC), which can significantly improve the slide characteristics, reduces cold welds and galling as well as minimises consumption of lubricants, as compared to traditional PVD coatings. DLC coating can improve the run-in characteristics of tools and precision components. It is more suited for low-tempered steel grades, for example, plastic mould steels.

Critical factors for successful PVD coating

Coating, with its 2 - 5 μm thickness, can not bear the entire load during production. Other than coating technology itself, there are several critical factors determining whether the coating can achieve the best result on the tool life.

TOOL STEEL

Hard coating is a way to resist surface failure and some kind of permanent failure from surface deterioration. This means that the uncoated tool itself must be able to carry the load. Hard coatings protect against abrasion, adhesion and oxidation, but not against deformation and cracks. The selected tool steel must be tough enough without risk of chipping or cracking.



HEAT TREATMENT

Properly hardened steel is the base for a good tool, and a necessary support for the hard coating. The hardness of tool steel should be ideally higher than 50 HRC if subsequently deposited with hard coating.

Normal processing temperature for PVD coating is 450 - 500°C. In order to prevent dimensional change during coating process, the tempering temperature should be higher than 500°C.

Tempering at least twice minimises the stress and risk of dimensional change caused by the transformation of retained austenite during coating process.

In special cases like plastic moulds which sometimes are tempered under lower tempering temperature like 250°C for Stavax ESR, several coatings like TiN, CrN, AlTiN can be deposited under lower temperature at the cost of adhesion of the coating. However, this adhesion strength shall be enough for plastic moulding processes.

Decarburising will lead to the decrease of the surface hardness, which shall be avoided during heat treatment. If the coating is applied on top of this low hardness surface, the coating layer will easily peel off.

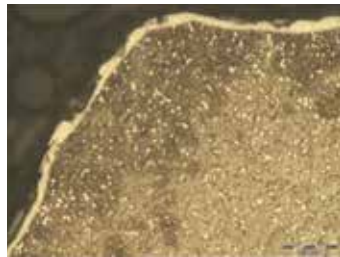


SURFACE QUALITY OF THE TOOL

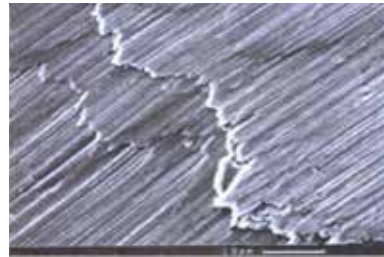
Appropriate preparation on the surface prior to coating is one of the most important factors for a successful coating. A surface is considered good for coating when it is:

- Fine ground
- Polished and metallically-cleaned
- Sufficient in substrate hardness
- Low in roughness ($R_z < 1 \mu\text{m}$)
- Properly heat-treated
- Protected against corrosion

Some kinds of surfaces are not suitable for deposition of coatings, for example, EDM eroded surfaces, hardened turning surfaces, nitrided surface and scaly material contusions, which are unfortunately frequently found in tool shops. Such kinds of surfaces lead to bad or even no adhesion for coating, therefore special preparation shall be carried out to remove such defected layer.



EDM ERODED SURFACE
No coating adhesion



SCALY MATERIAL CONTUSION
Bad adhesion of PVD

POLISHING

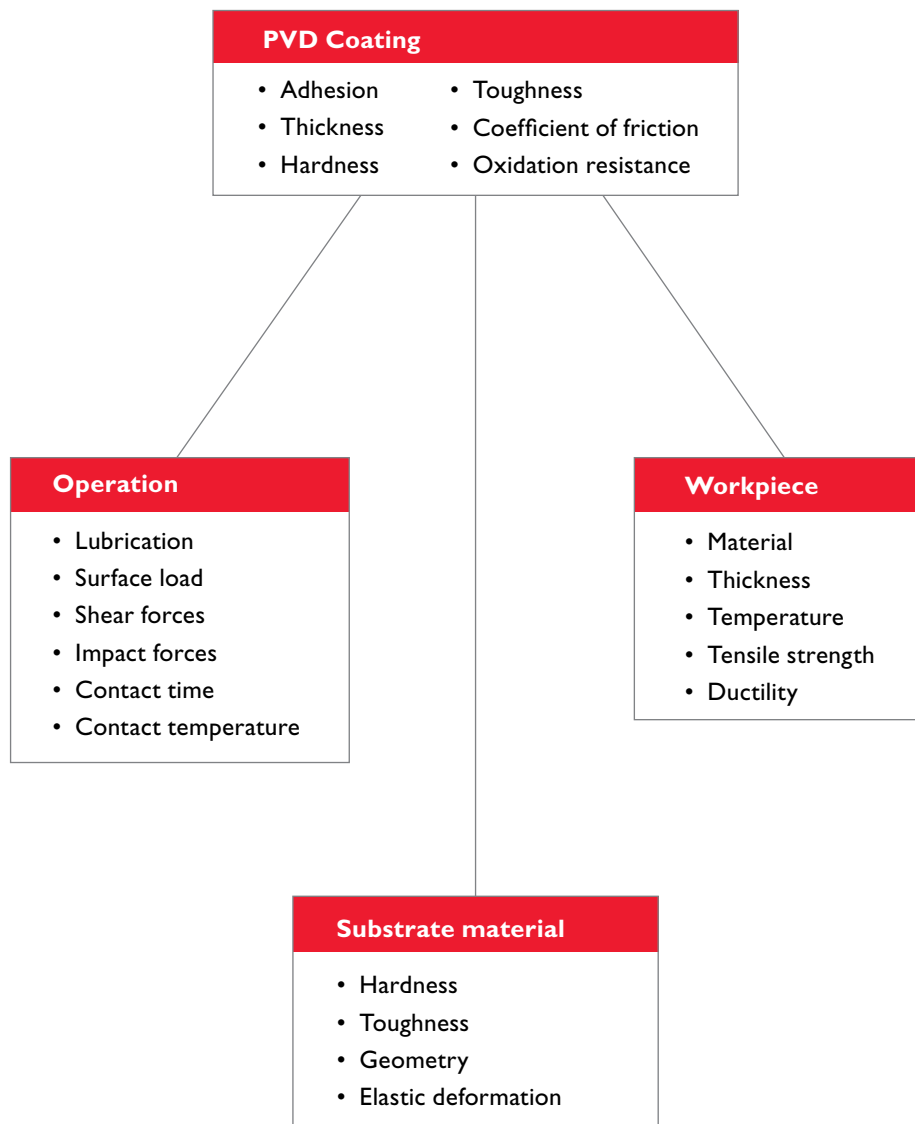
Highly polished surfaces are the most advantageous. The surface roughness shall be as low as possible. Polishing shall be done in a way not destroying the surface properties of the steel; otherwise it will result in delamination of the coating. It is better to use water-based polishing media, as it is easily removed during the following cleaning process before coating.

SURFACE CLEANLINESS

Although there is always a cleaning process before coating, it is highly recommended to keep the substrate as clean as possible before sending it for coating. Debris, residual working material as well as rusty scale shall be properly removed, especially from water channels, holes or areas where cleaning by ultrasonic cleaning machine is difficult. It is important that the substrate has good protection against corrosion. So, during transporting the substrate to the coating shop, apply anti-corroding oil on the substrate.

Application

The tailorability of layer structure and composition enables to develop various types of coating with different properties. The below illustration shows the factors that influence the selection of the right type of coating.



COLD WORK APPLICATION

In forming applications, galling, adhesive wear and plastic deformation are the most common failures encountered. Forming tools with better galling and wear resistance will be needed more in the future as the trend is towards an increased use of high strength sheet materials, higher press speeds, the use of progressive dies with fewer steps and the use of more environmental friendly but normally less effective lubricants. The following lists the most suitable coatings for the different types of needs or applications:

- If there is strong abrasive wear, use hard coatings like TiCN or VARIANTIC.
- If there is cold welding on the tool, use TiCN for stainless steel, DLC, CrN or CrCN for Aluminum or Copper material.
- If there should be a protection against high contact temperatures, use high Al-content coatings like SISTRAL, TIGRAL or EXXTRAL.

As mentioned before, Duplex coating with a plasma nitriding layer beneath the hard coating has a better support for the coating layer and therefore further increase the performance and tool life. As such, Duplex coating is strongly recommended for forming of high strength steel applications.

In blanking and cutting, it depends on the work material and the design of the die (tight die clearance in fine blanking for example), the tool failure can be plastic deformation, chipping, abrasive or adhesive wear. PVD coating can somehow increase the wear and galling resistance, and reduce chipping if it is caused by adhesive behaviour. SISTRAL with its nanocomposited structure and high Al content showing very high oxidation resistance, high hot hardness and high wear resistance, will meet the requirement for fine blanking, especially high speed fine blanking.

DUMATIC, which is thicker and has a much lower coefficient of friction than SISTRAL, can also be used for thick foil blanking if the working temperature is below 400°C. VARIANTIC also works perfectly in most blanking applications.



FORMING TOOL: TRAVERSE OF CAR

- Steel of sheet: QSTE, 2.2 mm
- Tool type: bending segments, 110 x 250 x 110 mm
- Preparation: mirror polishing
- Coating: PVD Duplex-VARIANTIC
- Performance: 450,000 parts

HOT WORK APPLICATION

Coatings with high Al contents normally have high temperature resistance, which means they can retain the hardness and chemical character even at elevated temperatures, therefore suitable for hot work applications.

In die-casting dies, in which cores 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 coatings can act as an insulating layer to prevent reaction between the die steel and the casting melt, hence minimising soldering. For some special cases where cooling is not sufficient or the melt velocity is too high due to design restriction in geometry, erosion and soldering can be a critical problem. In this case, hard and high temperature resistant PVD coatings like Duplex-TIGRAL and Duplex-TOPMATIC can help. There are also some restrictions when one applies PVD on die-casting dies, especially those with narrow cavities.

In hot forming of automotive parts, we recommend Duplex-TIGRAL for uncoated steel sheets. Its higher hardness will resist the wear from the scales. Duplex-TOPMATIC which has a lower hardness but thicker layer is suggested for AISi-coated steel sheets.

Unfortunately, in hot forging and extrusion applications, PVD coating is not suitable either because of the substrate softening due to high working temperature or the unfavourable cavity geometry.



Application: Die insert for water jacket
Material: DIEVAR
Material hardness: 40 - 42 HRC
Working material: Alloy 380 Aluminium

Solution:

- Duplex Tigral Coating

ASSAB COATING IMPROVES DIE INSERT LIFE

Description	No coating	Duplex Tigral
Die insert life	3,000 - 8,000 pieces	27,000 pieces

PLASTIC MOULD APPLICATION

Plastic moulds, hot channel injectors and valve pins can be coated by PVD. In most cases the tools for plastic moulding need a very smooth coating. This can be achieved with SPCS TiN-ultrafine coating. Quite often the customers use steel grades with a low tempering temperature of about 200°C, which makes it difficult to be coated with a standard arc coating process. Sputtering coating DLC on the other hand can be a very good choice like low temperature arc coating.

Coatings in plastic applications are mainly for increasing the cavity surface hardness, hence minimising scratches and protecting the polished surface against wear. Moreover, demoulding can also be improved because of reduced adhesion between the steel and the plastic. Multilayered CrN coating is proven to have very good corrosion resistance when the plastic is corrosive.

Sometimes post polishing is necessary if there is an extremely high requirement on the surface of the cavity.



SPCS TiN-ultrafine coating

Standard Arc TiN

Application: Injection moulded external car parts

Surface of product: Chromium plated

Surface of mould: Mirror polished

Benefits from SPCS TiN-ultrafine coating:

- Defect free chromium plating of plastic part
- Best surface quality of plastic part
- Improved mould release
- Preserved mirror polished mould surface

Coating portfolio

Name of Coating	Coating Material	Micro hardness HV _{0.05}	Coeff. of friction against steel	Coating thickness [µm]	Max. temp. of operation	Colour	General characteristic	Recommended applications
TiN	TiN	2300 ± 200	0.6	2 - 4	500°C	gold	All-round coating, bio-compatible	<ul style="list-style-type: none"> Punching and forming of iron-based materials
TiCN	TiCN (multilayer)	3500 ± 500	0.2	2 - 4	400°C	blue-grey	High hardness, excellent wear resistance, improved toughness	<ul style="list-style-type: none"> Punching and forming of abrasive materials and stainless steel
EXXTRAL (PLUS)	AlTiCrN (stacked)	3200 ± 300	0.4	2 - 5	800°C	anthracite	High hardness, high oxidation resistance, low coefficient of friction	<ul style="list-style-type: none"> Punching and forming of abrasive or sticking material (stainless steel, Si-rich Al alloys)
SISTRAL	AlTiN (nano-structured)	3400 ± 500	0.7	2 - 4	900°C	anthracite	High oxidation resistance; high warm hardness, high wear resistance	<ul style="list-style-type: none"> High performance coating for high process temperatures Very fine for fine blanking of steel
CROSAL	AlCrN based	3300 ± 300	0.4	2 - 5	1100°C	slate-grey	Extremely high oxidation resistance, high warm hardness, high wear resistance	<ul style="list-style-type: none"> Processing of steel at elevated temperatures and strong abrasive wear; dry cutting; fine blanking
VARIANTIC	TiAlCN (multilayer)	3500 ± 500	0.2	2 - 4	800°C	old-rose	Low friction, high oxidation resistance	<ul style="list-style-type: none"> High performance universal coating; for drawing and forming of high-and low-alloyed steel
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	<ul style="list-style-type: none"> Especially suitable for operating non-ferrous metals
ZrN / ZrCN	Zr(C)N (multilayer)	2800 ± 200 (3100 ± 300)	0.5	2 - 4	600°C	yellow / brown-silver	Low tendency for cold welding, excellent corrosion resistance	<ul style="list-style-type: none"> Mg die-casting, Al cutting
Varianta SUPRAL	AlTiCN	3500 ± 500	< 0.5	2 - 4	800°C	anthracite	High hardness, very good oxidation resistance, low friction	<ul style="list-style-type: none"> Machining of cast iron and high temperature alloys Excellent for drilling operations in steel
TIGRAL	AlCrTiN (nanolayer)	3300 ± 300	0.6	3 - 5	900°C	grey	High oxidation resistance, high warm-hardness, high wear resistance	<ul style="list-style-type: none"> All applications in machining of steel if temperature is high and abrasive wear is dominant
TOPMATIC	TiAlN	2800 ± 200	0.4	5 - 9	800°C	aubergine	Very high toughness, good oxidation resistance, high wear resistance	<ul style="list-style-type: none"> For applications in massive forming of steel For higher thicknesses
DUMATIC	TiN/TiC (multilayer)	3700 ± 200	0.3	3 - 5	400°C	silver-grey	Very high hardness, very high adhesive force, low coefficient of friction	<ul style="list-style-type: none"> Drawing and forming of high alloyed CrNi-steels Punching of thick steel foils and massive forming of steel
MoST	MoS ₂ : Me	500 - 1000	≤ 0.1	1	400°C	dark grey	High sliding capability, low abrasive wear	<ul style="list-style-type: none"> In combination with a hard coating Reduced friction wear
SUCASLIDE	a-C : Me	1800 - 2000	0.2	1 - 2	400°C	black	High sliding capability, reduced adhesive wear, bio-compatible and high corrosion resistance	<ul style="list-style-type: none"> Precision and sliding parts Punching and forming with reduced lubrication Cutting and forming of Al sheets
WC/C	a-C : Me	1000 - 2200	0.2 - 0.25	1 - 2	400°C	anthracite	low friction, low adhesive wear	<ul style="list-style-type: none"> Precision components In combination with a hard coating for forming and stamping, minimal cooling or dry Plastic injection moulds and slides, dry Very good for sliding parts

COATING RECOMMENDED FOR COLD WORK APPLICATION (BLANKING AND FORMING)

Coatings	Sheet	Non-ferrous	Aluminum		Standard		Stainless		High strength	Zn-plated
			≤ 3 mm	> 3 mm	≤ 3 mm	> 3 mm	≤ 3 mm	> 3 mm		
PVD	TiN				+					++
	TiCN				+++	++	++	+	++	++
	CrN	+++	+++	++						
	CrCN	+++	+++	++						
	VARIANTIC				+++	++	++	++	++	++
	CROSAL				+++	+++	++	++	+++	
	EXXTRAL-Plus					+++				++
	TIGRAL				+++	++				
	SISTRAL					+++	++			
	TOPMATIC					++			+	
	SUCASLIDE	++	+++							
MoST ¹⁾	++	+++		+++		+++			+	
Duplex-PVD	DUMATIC				+++		+++	++		
	Duplex-VARIANTIC				+++	+++	++	+++	+++	++
	Duplex-CrCN			-+++						+++
	Duplex-TOPMATIC				+++			++		

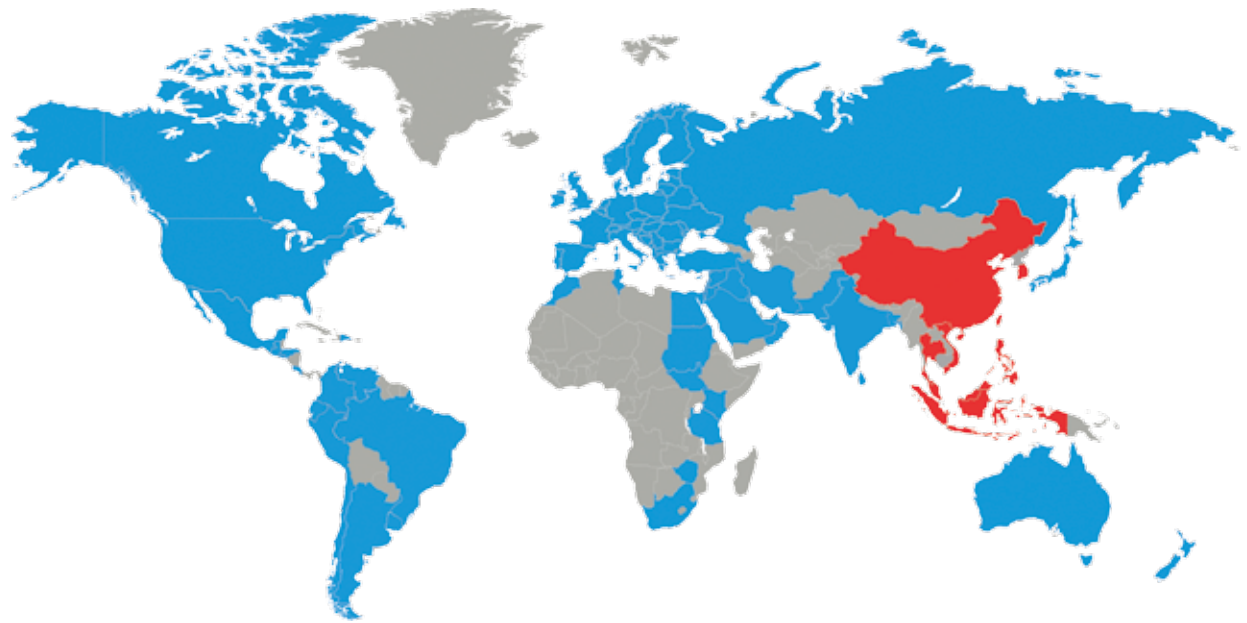
COATING RECOMMENDED FOR PLASTIC MOULDING

		Suitability				
		TiN	TiCN	CrN	TiAlN	SUCASLIDE
Thermoplastics						
Polyolefine	PE, PP, PB	+		++		+++
Styrol Polymerisate	PS, SB, SAN, ABS, ASA	+++		++		
Cl containing Polymerisate	PVC			++		
Fl containing Polymerisate	PTFE, PVDF			++		
Acetal resins	POM	++		++		
Polyamide	PA	+++		+++	++	++
Linear Polyester	PC, PBT(B), PET(P)	+++		+++		
Polyarylenethene	PEEK, PPS, PSU, PES, PPE, PPO	+	++	+++	+++	
Polyimide	PI	+++				
Celluloseester	CA, CP, CAP	+++				
Polyacrylate	PMMA	+++				
Polyurethane	TPU			+++		
Duroplastics						
Polyurethane	PUR			++		
Aminoplastics	MF, UF, MP	++		+++		
Elastomers						
Polyurethane	PUR			+		
Synthetic rubber	NBR, EPDM, SI			++		
Fl containing Elastomers	Multipolymer-TPF, FPM			++		
Improvement						
Abrasion		++	+++	++	+++	+
Adhesion		+	+	++	+	+++
Corrosion			+	+++	++	++
Sticking		+++	++	+++	++	++
Demoulding		+	+	++	+	++
Filling		+	+	+	++	++

COATING RECOMMENDED FOR HOT WORK APPLICATION

Type of Toolings	Coatings	Applications
Al Die Casting	Duplex-TIGRAL	Reducing erosion, corrosion and soldering of cores, ejectors, pins and cavities with simple geometry, especially when washout is the dominant failure
	Duplex-TOPMATIC	Similar applications as Duplex-TIGRAL, but much better for toolings with narrow and complicated cavities
Hot Stamping	Duplex-TIGRAL	Suitable for uncoated steel sheets
	Duplex-TOPMATIC	Suitable for coated steel sheets e.g. AlSi-coated steel sheets

¹ Mostly on top of a hard coating +++ very good ++ good + fair



Choosing the right steel is of vital importance. ASSAB engineers and metallurgists are always ready to assist you in your choice of the optimum steel grade and the best treatment for each application. ASSAB not only supplies steel products with superior quality, we offer state-of-the-art machining, heat treatment and surface treatment services to enhance steel properties to meet your requirement in the shortest lead time. Using a holistic approach as a one-stop solution provider, we are more than just another tool steel supplier.

ASSAB and Uddeholm are present on every continent. This ensures you that high-quality tool steels and local support are available wherever you are. Together we secure our position as the world's leading supplier of tooling materials.

For more information, please visit www.assab.com