Coatings

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Physical Vapor Deposition
PVD defined

Physical vapor deposition (PVD) is fundamentally a vaporisation coating technique, involving transfer of material on an atomic level. It is an alternative process to electroplating. The process is similar to chemical vapor deposition (CVD) except that the raw materials/precursors, i.e. the material that is going to be deposited starts out in solid form, whereas in CVD, the precursors are introduced to the reaction chamber in the gaseous state.

How Does Physical Vapor Deposition Work?

PVD processes are carried out under vacuum conditions. The process involved four steps:

1. ***Evaporation***: During this stage, a target, consisting of the material to be deposited is bombarded by a high energy source such as a beam of electrons or ions. This dislodges atoms from the surface of the target, 'vaporising' them.
2. ***Transport***: This process simply consists of the movement of 'vaporised' atoms from the target to the substrate to be coated and will generally be a straight line affair.
3. ***Reaction***: When coatings consist of metal oxides, nitrides, carbides and other such materials, the target consists of metal. The atoms of metal react with the appropriate gas during the transport stage.
4. ***Deposition***: This is the process of coating build up on the substrate surface.

What are PVD Coatings Used For?

PVD coatings are deposited for numerous reasons. Some of the main ones are:

- Improved hardness and wear resistance
- Reduced friction
- Improved oxidation resistance

The use of such coatings is aimed at improving efficiency through improved performance and longer component life. They may also allow coated components to operate in environments that the uncoated component would not otherwise have been able to perform.

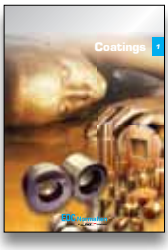
Physical Vapor Deposition
PVD defined

Advantages of the Physical Vapor Deposition Process

- Materials can be deposited with improved properties compared to the substrate material
- Almost any type of inorganic material can be used as well as some kinds of organic materials
- The process is more environmentally friendly than processes such as electroplating

Applications

PVD coatings are generally used to improve hardness, wear resistance and oxidation resistance. Thus, such coatings use in a wide range of applications such as Aerospace, Automotive, Surgical/ Medical, Dies and molds for all manner of material processing, Cutting tools, ...



Info

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DME - EOC:
your expert partner of choice in all aspects of surface finishing

We are delighted to present our new surface finishing catalogue to you today. Our product portfolio, which has been especially expanded for you, now contains everything for the manual secondary processing of your dies, forming tools and stamping tools, ranging from simple rough polishing to fine-finishing.

Save time and money with us:

Our aim is not just to sell; our primary goal is to be an expert partner of choice in all aspects of surface finishing!

The large number of finishing tools, polishing stones, diamond pastes, tools and hand pieces etc. often makes the right choice difficult in the case of certain finishing problems with different steels and with varying starting conditions and demands in terms of the end result.

Fast deliveries

Onsite interventions

Polishing course

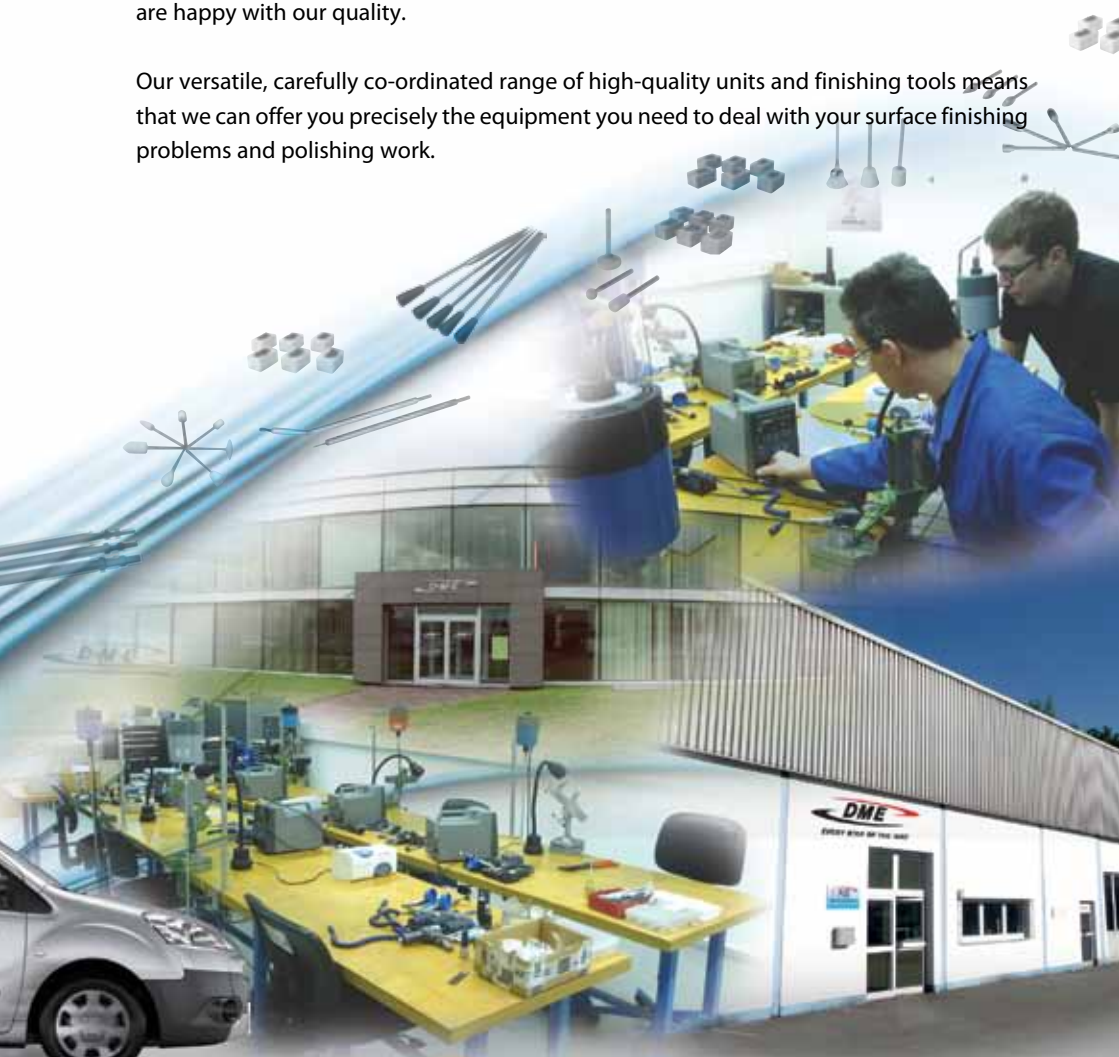
Choosing unsuitable tools for certain polishing jobs and the inefficient use of polishing tools cost you time and money.

We therefore feel it is essential to provide customer-specific consultation for all aspects of and problems with surface finishing. Our team which has over twenty years' experience in the fields of surface finishing and die polishing can give you the best possible advice.

Fast, reliable, durable and precise:

All the tools and polishing agents we sell undergo a rigorous series of tests to confirm their optimum handling, grain quality, reliability and robustness for day-to-day operations in practice in the polishing workshop of our PVD carbide coating centre to ensure that you are happy with our quality.

Our versatile, carefully co-ordinated range of high-quality units and finishing tools means that we can offer you precisely the equipment you need to deal with your surface finishing problems and polishing work.



Info

Polishing courses

On course for success with *DME*:
Try our polishing courses … beginners and advanced.

In our two-day courses we give you a comprehensive overview of a very wide range of polishing strategies. We show you what steps are necessary to achieve a variety of finishes economically and reliably for a very wide range of applications.

Day 1. **Theoretical principles and start of practical exercises**
The subjects covered include the following:

- Definitions of grinding, lapping, buffing and polishing
- Definitions of different DIN-specified roughness ratings
- Achievable roughnesses as a function of different grain types, grain sizes, different binding and carrier hardnesses of different tool steels
- Effect of varying heat treatments for different tool steels on the polished finish
- Effect of pre-treatment on required polishing strategy
- Systematic design of a mould polishing finish
- Correlation of polishing input to desired outcome
- Avoidance of manual polishing errors (geometry)
- Avoidance of manual polishing errors (structure)
- Polishing repairs following mechanical or chemical damage
- What PVD carbide coatings can be used to address various problems (e.g. mold release, deposits, gas evolution, abrasive wear etc.) with different (filled) injection-molded masses
- Sensible combination of different polishing instruments - the polishing workplace tailored to your needs

Once the theory section is complete, the first practical exercise involves the use of different polishing agents. To get a feel for the different polishing tools, you work in groups with different grain types and grain sizes with varying binding and carrier hardnesses with the aim of achieving a superfinished plane workpiece.

Day 2. **Practical principles for achieving polished finishes on tools**

Each polishing course participant works on two mold inserts specially manufactured for the courses with the aim of achieving a superfinished product. No strictly specified stages are followed; instead alternative finishing options are demonstrated with the aim of determining the most efficient means of reaching the target of a superfinished product.

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Polishing courses

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Exercise 1

Achieving a superfinish with rotary tools
Alternative finishing methods are presented to the course participants. Each course participant decides his own finishing strategy for achieving the same final result in each case. The different finishing methods are then discussed, unnecessary and wrong finishing stages are explained, thus revealing the way to achieve an efficient mold finish with the optimum result for the specific purpose.

Exercise 2

Achieving a superfinish with linear tools
This primarily involves the use of hand filing machines and ultrasonic polishing systems. Here, too, various finishing options are tried out and then discussed.

The purpose of dividing up into different finishing options is to demonstrate that the different polishing strategies can result in the same outcome. Our aim is not to force any generally applicable "formula" on the course participants. Instead, we wish to stimulate people to think about certain finishing methods and to identify and encourage individual aptitudes among the course participants to ensure that sustained efficiency is achieved in the polishing work carried out by your company.

Other specialised courses that we offer:

- In-house training courses on our customers' premises
- Special polishing courses for our customers in our training rooms

Firstly we analyse your finishing problems on-site and then draw up a training programme tailored specifically to your requirements.

Please ask for details of the courses we offer.

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Info

PVD coatings

DME has taken over the license for a new surface coating for metal tools and parts from the American corporation Micro Surface Inc. that we want to introduce to you under the name **LAMCOAT®.**

This surface coating - quite unique in Europe - is in many ways an excellent addition to PVD hard material coatings such as Titanium-Nitride (TiN) or Chrome-Nitride (CrN) and can be used on all hard and soft metals.

The coating was developed for space travel and has been applied and tested there for years under extreme conditions in all movable elements in mechanical, electrical and hydraulic parts. In the USA, it is applied by service companies and new applications are constantly being developed.

A key characteristic of **LAMCOAT®** is the considerable reduction of friction by approximately 70% depending on application and use, as well as the resulting excellent lubricating and sliding properties.

LAMCOAT® is a tungsten-disulfide based soft coating that is applied at room temperature with a thickness of between 0.0005 and 0.0015 mm.

LAMCOAT® is used in many industries throughout the USA such as:

- Plastics technology
- Automobile industry
- Press technology
- Ball bearing industry
- Machine construction
- Cutting technology
- Drive technology
- Hydraulics
- Electrical engineering
- Space travel
- Aircraft industry

LAMCOAT® applications

Plastics technology

1. Ejection
LAMCOAT® reduces friction resistance, resulting in

- Less force required
- Lower energy costs
- Reduction or even dispensing with form cut-offs
- High-grade part surfaces because the deformation risk is minimized

2. Cycle time
Due to the reduction of friction, a shorter cycle time can be achieved and/or depending on the material, the injection temperature can be reduced so that the cycle time can be shortened. This is demonstrated by comprehensive tests conducted in the USA in which almost all common materials showed a reduction in cycle time in connection with the advantages mentioned under Point 1. Further details available on request.

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3. Movable parts
All movable parts such as slides, ejection pins and also cylinder liners and rods can be coated with **LAMCOAT®** and are maintenance-free when properly used.

4. Harmlessness
In the USA, the **LAMCOAT®** coating has obtained harmlessness certification for the production fields in which **LAMCOAT®** coated materials are used for the manufacture of products for the foodstuffs and pharmaceutical industries.

Press technology

Due to its excellent lubricating and sliding properties, LAMCOAT® is used in pressing and drawing processes. LAMCOAT® can be seen here as an addition to the PVD coating. The pressing time of the PVD coated drawing mandrels and matrixes is increased by the use of **LAMCOAT®** due to its better lubricating and sliding properties. At the same time, the use of lubricants and greases can be reduced. The coating brings advantages in the use of all materials such as sheet steel, in all alloys and non-ferrous sheets and coated sheets.

Moving elements in pressing tools such as slides or other functional elements, as well as coated rods and bushings become maintenance-free. Here, the laminated steel bushings with **LAMCOAT®** coating are especially to be recommended. As is known, laminated steel bushings with bronze coating have a longer life than traditional steel bushings. In addition, with the material combination of bronze coated steel guide pins and **LAMCOAT®** coating, the guide properties are improved and the pressing time (life) increased.

Ball bearing industry

Ball and roller bearings can be coated before installation or in assembled condition with **LAMCOAT®**. With the reduction of friction, generation of heat can be reduced even under heavy loads. In addition, in many cases further lubrication can be dispensed with so that the ball bearings are maintenance-free.

Mechanical bearing points

The use of **LAMCOAT®** for radial or axial movement of components or machine parts can result in many cases in maintenance-free bearing points.

Cutting tools

In current cutting technology a PVD hard material coating such as TiN, CrN or others is really state-of-the-art. **LAMCOAT® causes a further reduction in friction and reduces the weld-on process through better cuttings removal.**

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PVD coatings

LAMCOAT® specifications

LAMCOAT® is a tungsten–disulfide based soft coating. The **LAMCOAT®** coating process occurs at room temperature - deformation or change of surface structure does not occur. The coating takes places without adding binder or chemical additives. The coating makes a molecular connection.

Coating thickness

LAMCOAT® coating thickness is between 0.0005 and 0.0015 mm. The coating is evenly applied to all surfaces. The coating is blue/grey and has a changed appearance depending on the surface of the coated part.

Temperature range

LAMCOAT® can be used from -273°C to approximately +400°C (for short periods up to +652°C). When used in a vacuum: 10-10 mbar –188 °C to +1316 °C.

Chemical stability

- **LAMCOAT® is chemically neutral, corrosion resistant and non-toxic.**
- It can be applied to all fixed metal surfaces.
- It is resistant to most solvents, petrol and chlorine compounds.
- It is affected by sulphuric acid and hydrofluoric acid as well as hot caustic alkaline leaches.
- **LAMCOAT® itself is corrosion-resistant without, however, being able to prevent non-corrosive carrier materials from being affected.**

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Compatibility

LAMCOAT® is successfully used in combination with petro-chemical oils and lubricants, synthetic lubricants, silicon lubricants and hydraulic fluids. It can take up lubricants and attempts to form and maintain a hydro-dynamic layer. We apply the following PVD hard material coatings:
LAM – A (CrN)
LAM – B (TiN)
LAM – C (TiCN)
LAM – D (TiAlN)

Savings and higher quality by means of product-specific hard material coating:
A hard material coating is used depending on duty and purpose. Experience has shown that applying the correct hard material coating on the "right" surface is key.

Plastics technology

Here, advantageous use is made of hard material coatings, in particular LAM-A (CrN) and LAM-B (TiN). Coatings are applied to shaped contours, wholly or partially, as well as movable elements such as slides, ejectors, etc.

Press technology

The best results have been achieved with LAM-A (CrN) and LAM-B (TiN) whereby the coating is oriented towards the material to be processed, such as stainless steel sheets, non-ferrous metals, uncoated or coated sheets. The coating offers clear advantages when applied on hole-punching and cutting bushings as well as in moving parts in deformation technology.

Cutting technology

Also here, one of the possible PVD coatings can be used depending on the area of application. A higher degree of usage as well as an increase in cutting speed and advance, and an improved surface quality can be achieved for all milling, turning or drilling tools.

Special advantages of the LAMCOAT® coating:
Key features of the LAM-A (CrN) coating are high abrasion and excellent adhesive strength. The metallic blue surface has a particularly low friction coefficient that can be improved by additional polishing. The coating is especially useful in metal forming and plastics technologies.

Today, hard material coatings are applied on modern installations for temperatures from 200°C.

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PVD coatings

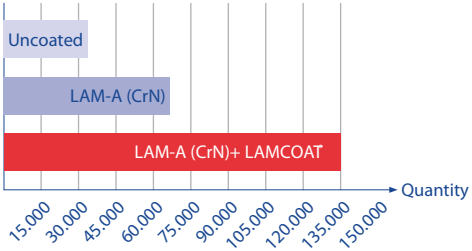
LAMCOAT® coating

This type of coating was developed in the USA for space travel and has since been used in many areas of mechanics, electrics and hydraulics. LAMCOAT® is a tungsten-disulfide based soft coating, applied at room temperature, with a thickness of between 0.0005 and 0.0015 mm. This coating reduces friction by up to 70% depending on application. This surface coating with excellent lubricating and sliding properties is in many cases the ideal addition to PVD hard material coatings.

Areas of application

... For mechanical/dynamic parts:

- Metal forming: drawing pressing and forming tools for working non-ferrous metals and chrome-nickel steels
- International racing: effective performance increase by 10% by coating the drives
- Bearing for large presses: reducing the internal temperature by approximately 20% by reducing friction
- Ball bearings for high and ultra-high vacuum applications
- Special ball bearings: functional improvement
- Pump elements: increasing cost-effectiveness by reducing friction



Stamping time comparison:
Example: Drawing ring of material 1.2379 hardness 62 HRC
Drawing region in material flow direction highly polished,
3.0 mm steel sheet, active diameter ø 90 mm, drawing depth 60 mm.
Uncoated and with LAM-A (CrN) coating
lubricated with drawing oil.
With LAM-A (CrN) plus LAMCOAT® drawing was carried
out only with the corrosion protection of the strip

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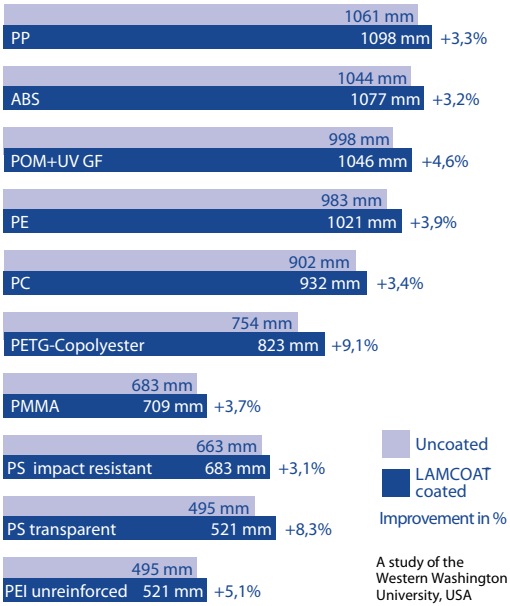
... For spray molding tools:
Quick filling of cavities
For most plastics low removal force
Reducing tool temperature
Reducing cycle time
Fewer form separating media need to be used
Increasing production safety
No change in the part geometry when removing
Less waste

... For forming tools
Reducing lubricant quantities
Increase in usage times



Filling study
Injection molding tool with spiral geometry:
3 – 9% increase per flow path length

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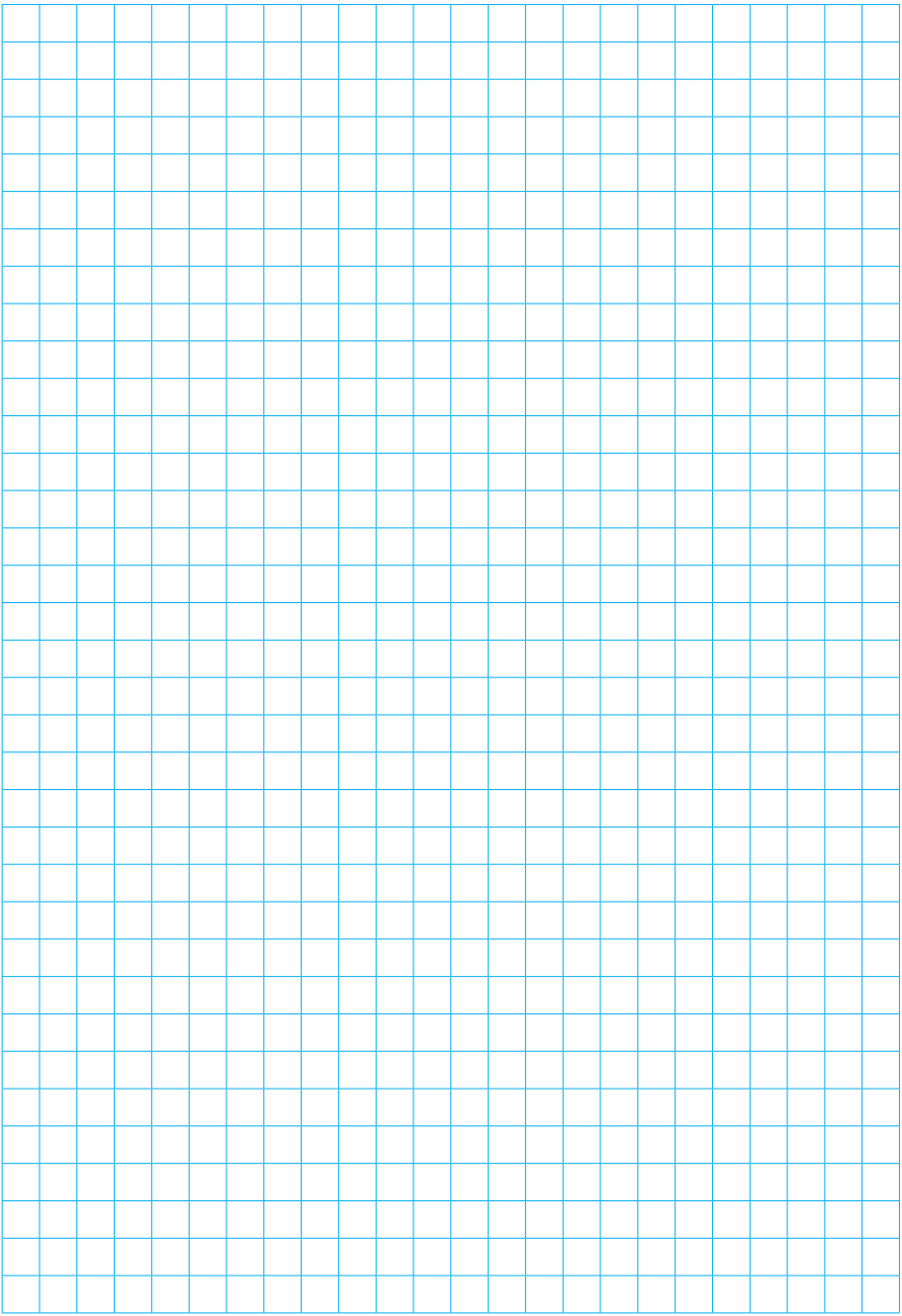

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