TAKE CARE, HAVE A COATING!

WEAR-RESISTANT COATINGS - ANTIFRICTION
This development has made it possible to improve the characteristics of this technology, while diminishing its weaknesses. Today, for example, with the cathodic arc, it is possible to achieve high levels of ionization of the plasma through the use of sources of new generation which, besides improving the intrinsic quality of the deposited layers, in parallel allow to reduce to a minimum the phenomenon of "droplets", which has always been considered the only small demerit of this technology.

"Droplets" effect refers to the presence in the deposited layer of tiny droplets of material that, after being evaporated, has aggregated not in atomic form.

The modern technology available today in STS, called HDP, allows to obtain layers of coatings almost "droplet-free".

STS TECHNOLOGY

The continuous testing of different compounds for the realization of new coatings, has increasingly directed the development towards the cathode sources, in order to be able to deposit alloys of dissimilar elements (eg Nitrides of Titanium and Aluminium, Titanium nitrides and silicon, etc.).

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The most recent result of technological development in the field of PVD coatings is referred to by the acronym of HDP (High Density Plasma). The name identifies a highly evolved HDP deposition system at high-density plasma which allows to reach levels of performance never achieved before.

Based on the arc cathode, the system combines HDP new technical solutions that allow the deposition of coatings with process parameters that were previously considered impractical, thus obtaining sensational results as the elimination of “droplets” (for years considered as congenital of the arc technology), together with an extraordinary speed of deposition (4-5 µm/hour).

Taking into consideration instead the intrinsic structure of the coatings due to its superior plasma density obtained with the HDP system, highly compact layers capable of reaching higher levels of hardness are made, while managing to maintain an equally high degree of toughness.

HDP is based on a high plasma density obtained thanks to new cathodic sources combined with a pulsed polarization of the parts to be coated.

The compliance of the STS Quality System management is recognized and attested by the UNI EN ISO 9001:2008 Certification.
DLC is an innovative carbon-based coating with wide spectrum of application which allows you to deal with problems related to abrasion, to chemical attack and sliding.

The low deposition temperature, the hardness and the low coefficient of friction make it of extreme interest.

It is applied on finished parts while maintaining the state of the surface finishing.

The DLC is deposited by the PA-CVD (Plasma Assisted - Chemical Vapour Deposition) technology which allows to maintain low temperature of depositing and at the same time ensures an excellent adhesion.

### TIPS/SUGGESTIONS

The high hardness and low friction coefficient arise from the simultaneous presence of sp² hybridized Carbon (Graphite) and sp³ (Diamond).

It works very well for dry contacts.

### Benefits

- High hardness (resistance to abrasion and wear)
- Low coefficient of friction (smoothness and anti-adherence)
- Excellent chemical inertia (resistance to corrosion and chemical attack by acids, bases and salts)
- Compactness (impermeable to gases, such as to Hydrogen)
- Electrical insulation
- Biocompatible

### SUBSTRATES

- Steel, ferrous alloys in general
- Aluminium and its alloys
- Titanium and its alloys
- Copper and its alloys (bronze, Cu -Be)
- Tungsten Carbides

<table>
<thead>
<tr>
<th>Basic Composition</th>
<th>Deposition Technology</th>
<th>Microhardness (HV 0.05)</th>
<th>Coefficient of friction against 100 Cr 6</th>
<th>µm thickness (microns)</th>
<th>Deposition Temperature (°C)</th>
<th>Max Temperature of use (max °C)</th>
<th>Colour</th>
</tr>
</thead>
<tbody>
<tr>
<td>a-C:H sp²-sp³</td>
<td>PA-CVD</td>
<td>1.500 - 3.000</td>
<td>0.05 - 0.1</td>
<td>0.5 - 3</td>
<td>250</td>
<td>400</td>
<td>Black</td>
</tr>
</tbody>
</table>
MAGNETRON SPUTTERING TECHNOLOGY

Developed for tribological applications, WC/C is a layer composed of Tungsten carbide lamellae alternate to amorphous carbon lamellae and is deposited by means of Magnetron Sputtering technology.

The WC/C coating is equipped with high hardness, good wear resistance and it is also antiseptic.

But the characteristic for which is appreciated most is the low coefficient of friction which makes this layer an excellent solution to prevent phenomena such as seizure adhesives and cold welding.

In this regard, the WC/C covers all the sliding/rolling parts such as engine gears, camshafts, compressors’ screws, guideways, ball bearing rings, worms, and all the moving parts in poor lubrication conditions.

The WC/C is accepted by the FDA (Food and Drugs Administration) and since long time it has been applied in the food industry on various types of elements such as blades and discs for cutting tea and coffee, dispensers and parts for the handling of tobacco, pasta and olive oil.

The WC/C is deposited through a process that develops a temperature not exceeding 180°C, and this allows its application to a wide variety of materials ranging from Titanium and its alloys up to different types of Steels with a particular statement by the range of Stainless Steels and Cementation Steels.

The WC/C is one of the ceramic coatings that comply with the dictates of ISO 10993.

According to this Norm, the WC/C is declared biocompatible and shows no cytotoxicity, skin irritation and acute systemic toxicity.

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<tbody>
<tr>
<td>Carbide of Tungsten and Carbon</td>
<td>Magnetron Sputtering</td>
<td>1.300 - 1.500</td>
<td>0.15</td>
<td>1 - 4</td>
<td>&lt;180</td>
<td>350</td>
<td>Anthracite</td>
</tr>
</tbody>
</table>
PVD MAGNETRON SPUTTERING TECHNOLOGY

MOVIC® is a self-lubricating and anti-adhesive coating based on MoS₂ (Molybdenum Disulphide), and is produced with PVD Magnetron Sputtering technology. Developed in aerospace from the need to find an alternative to traditional lubricants (e.g., oil, grease) when their use is not permitted, revealed excellent tribological properties that have made him, as a result, very interesting for a variety of application fields.

TECHNICAL FEATURES/SPECIFICATIONS

- Monophase amorphous self-lubricating coating based on MoS₂.
- “Soft” coating with a very low coefficient of friction (friction coefficient in dry air <0.05).
- Coating monolayer that can be combined with any hard coating.
- Functional coating thickness <0.5 microns.
- Deposition temperature <150 °C.
- Traces of soft wear, lubricants (“Fail-safe” behavior, that is no abrasive particles are created by the wear of the coating).
- Great running-in on rough surfaces (the coating becomes smoother during the running-in).
- Positive transfer of the lubricant film on the body and contact.
- MOVIC® can be easily re-coated. If necessary the removal is easily achievable.

WHY MOVIC® BEHAVES LIKE THAT.

To understand the mechanism of sliding, you have to think about the crystal structure of molybdenum disulphide, which is the basis of MOVIC®. As can be seen in the illustrations below, the structure of the MoS₂ is similar to that of graphite, with sliding planes that are oriented in the direction of the stress, thus creating a lubricating effect.

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<tr>
<td>MoS₂</td>
<td>Magnetron Sputtering</td>
<td>-</td>
<td>0.1</td>
<td>1</td>
<td>&lt;100</td>
<td>700</td>
<td>Grey</td>
</tr>
</tbody>
</table>
**PVD TECHNOLOGY**

**PLC** stands for Polymer Like Carbon and is classified as Me-DLC.

It is a Carbon based coating containing doping metal elements and non, in which the carbon is hybridized in both sp² sp³ in variable percentages and dependent on deposition factors.

**PLC** is a hydrophobic monolayer coating with thickness of 1 micron and with a hardness of about 1500 HV.

It is possible to deposit this coating at temperatures ranging from 140 °C to 480 °C depending on the characteristics of the material on which it must be reported.

The coefficient of friction of 0.1 value makes this coating a great anti-friction and anti-seizure solution.

It is combinable and superposable with any other **STS PVD** coating exalting the characteristics of each of them.

It is applicable on all Steels, on Titanium, on Copper and their alloys.

The use of **PLC** is very appreciated in areas such as automatic machines where the mechanical parts are subject to friction, and in the automotive sector.

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<th>Basic Composition</th>
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<tbody>
<tr>
<td>Carbon</td>
<td>Monolayer</td>
<td>1.500</td>
<td>0.1</td>
<td>1</td>
<td>140 - 480</td>
<td>300</td>
<td>Dark Grey</td>
</tr>
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HDP-PVD TECHNOLOGY

The Chromium Nitride, better known as CrN, has many important features that suggest its use in many applications.

Also, in STS, is deposited with the latest technology HDP (High Density Plasma) which favors the formation of extremely compact layers.

Although the CrN can express a considerable hardness, it has a very tenacious structure, thanks to which it is possible to reproduce layers with thicknesses much higher compared to all the other coatings (up to 15 microns).

This advantage combined with excellent resistance to corrosion make the Chromium Nitride an extraordinary barrier to chemical attack and oxidation.

The low friction coefficient of this coating also allows to reduce the phenomena of seizure and microsolderings between sliding surfaces.

The CrN also has excellent resistance to thermal loads and it is therefore interesting to use in high temperature conditions.

Another important element is the ability to deposit the CrN at low temperatures (up to 180°C) by extending its application to a multitude of different materials.

The Chromium Nitride is also accepted by the FDA (Food Drug Administration).
HDP-PVD TECHNOLOGY

The TiCN coating comes from an evolutionary study of the precursor TiN, inheriting the already appreciated qualities and improving some of its features.

In fact, thanks to the introduction of the Carbon (C) within the layer, it was possible to obtain a structure that has a hardness greater than 50% compared to that of TiN.

In consequence to this, the TiCN coating ensures a higher wear resistance.

A further improvement of the TiCN was achieved by developing a “multilayer” (multi-layer) composed of several hundreds of different layers that give better control of structural stress within the coating.

Nevertheless, the final maturation of the TiCN coating was made with the introduction in STS of the new HDP system (High Density Plasma) which can improve the characteristics of this layer, making it even more efficient.

As the TiN, TiCN also complies with FDA (Food and Drugs Administration) and can then be applied with success in the field of automatic machines dedicated to the processing of tobacco or for the packaging of sugar, pasta or paper processing.
PVD-HDP TECHNOLOGY

The Titanium Nitride better known as TiN, has been on the market for decades and still occupies a position of absolute importance in the panorama of PVD coatings.

TiN has always been a reference in the field of cutting tools, and its properties also arouse much interest in many other fields of application.

The recent development of HDP technology (High Density Plasma) by STS, has allowed to improve the TiN characteristics, creating a layer with a very smooth and compact surface, which can be deposited at low temperatures (150°C).

If you associate these new conditions to the fact that TiN complies with ISO 10993 (biocompatibility) and FDA (Food and Drugs Administration), one can easily imagine how this coating turns out to be a good solution in the areas of medical, food industry, automatic machines, racing and mechanical parts.

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<tbody>
<tr>
<td>Titanium nitride</td>
<td>Monolayer</td>
<td>2.200</td>
<td>0.6</td>
<td>1 - 4</td>
<td>140 - 480</td>
<td>500</td>
<td>Yellow gold</td>
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