PVD AND P$\text{a}$CVD COATINGS
FOR COMPONENTS
ANTIWear | ANTIFRICTION | ANTICORROSION | DECORATIVE
Take care, have a coating.

STS started in 1991 from the idea of building an innovative center specialized in PVD coatings.

The experience and know-how gained over time have allowed us to develop specific solutions for various application fields and able to contrast the following phenomena: wear, friction, fretting, chemical corrosion and thermal fatigue.

Today we are at the forefront of PVD and PaCVD coating technology and we are recognized as a leader in the treatment of components and molds for the industrial sector.

Constant research and development activities and investments in the most advanced technologies favour our approach to multiple sectors such as: industry, aerospace and defense, automotive and racing, food processing and packaging, textile, health and fashion.

Always attentive to market needs, we work to offer a precise and global service, with constant attention to specific needs of the customer.

But the strength we are most proud of comes from our company staff, built-up over the years through a passionate teamwork. A close-knit team made of highly specialized professionals, eager to provide a quick feedback and suitable solutions to every need.
Coating deposition technologies.

The deposition technologies used by STS are PVD (Physical Vapor Deposition) and PaCVD (Plasma assisted Chemical Vapor Deposition). Both are to be considered as depositions in plasma [2].

The aim is to combine metals (Ti, Al, Cr ...) with Non-metals (N, C) to produce layers with good tribological characteristics.

Metal is made available through Arc evaporation [3] or by Sputtering [4]. Non-metal is supplied as gas [5]; their reaction produces the coating which adheres to the substrates thanks to the potential difference [1].

Green technology

STS coatings are deposited with the vacuum technique. Reagents and wastewater have zero environmental impact. Therefore our technology is "green" in all respects.

Quality and certifications.

Production excellence is the primary objective of STS, pursued at every stage of our processes. Our competence and our technological advancement are recognized and certified by important Certifications and Declarations of conformity.

Certifications

ISO 9001 / ISO 14001 / ISO 45001
IATF 16949
OHSAS 18001
EN 1935
FDA
UNI EN ISO 10993
REACH
ROHS

Declarations of conformity

EN 1935 Food
FDA Food USA
UNI EN ISO 10993 Medical
REACH Environmental
ROHS Environmental
DLC is an innovative Carbon-based coating with a wide spectrum of application that allows you to address problems related to abrasion, sliding and chemical aggression. The low deposition temperature, the hardness and the low friction coefficient make it extremely interesting. It is successfully applied on finished details while maintaining the state of surface finish. It is biocompatible and suitable for food contact.

**Characteristics:**
- Low friction coefficient
- Chemical inertia
- High hardness
- Electrical insulator
- Biocompatibility
- Food contact

**Benefits:**
- Sliding
- Anti-sticking
- Resistance to corrosion/oxidation and chemical aggression
- Resistance to wear and abrasion
- Solution for Tribocorrosion/Fretting/Galling phenomena

**Technical Data**
- Thickness: 2-3 μm
- Hardness: 2200 Hv
- Friction coeff. against 100 Cr 6: 0.12
- Deposition temperature: max 200°C
- Max working temperature: 350°C
- Color: black

DLC Slide is defect-free and has a low friction coefficient. It is successfully used to better cope with cold adhesion and sticking phenomena as well as to reduce the overall system frictions.

**Technical Data**
- Thickness: 2-3 μm
- Hardness: 2200 Hv
- Friction coeff. against 100 Cr 6: 0.12
- Deposition temperature: max 200°C
- Max working temperature: 350°C
- Color: black

DLC NOX high chemical inertness makes it particularly suitable for dealing with corrosion and oxidation phenomena.

**Technical Data**
- Thickness: 3-5 μm
- Hardness: 2200 Hv
- Friction coeff. against 100 Cr 6: 0.16
- Deposition temperature: max 200°C
- Max working temperature: 350°C
- Color: black

High thickness and high hardness are the main characteristics that allow DLC PRO to better face wear abrasion phenomena.

**Technical Data**
- Thickness: 3-6 μm
- Hardness: 2600 Hv
- Friction coeff. against 100 Cr 6: 0.15
- Deposition temperature: max 220°C
- Max working temperature: 350°C
- Color: black

DLC DECO high strength and high hardness are the main characteristics of DLC DECO. Deposited with averaged powers, it is best suited to the most delicate components.

**Technical Data**
- Thickness: 1-2 μm
- Hardness: 2200 Hv
- Friction coeff. against 100 Cr 6: 0.12
- Deposition temperature: max 150°C
- Max working temperature: 350°C
- Color: black
**HDP X5**
Composition: Chrome and Titanium based multilayer
Deposition technology: High Density Plasma

Our new HDP X5 coating was created with the aim of **improving resistance to abrasion and corrosion**. With the addition of transition elements it’s possible to obtain a structure with lattice parameters that reaches hardnesses close to 3000HV and a more compact structure: these characteristics make it a coating more resistant to abrasion, corrosion and sticking.

**TECHNICAL DATA**
- **Thickness**: 3-6 μm
- **Hardness**: 2900 Hv
- **Friction coeff. against 100 Cr 6**: 0.5
- **Deposition temperature**: 280°C - 480°C
- **Max working temperature**: 700°C
- **Color**: grey-yellow

**APPLICATION FIELDS**

**CHARACTERISTICS:**
- Chemical inertia
- High hardness

**BENEFITS:**
- Abrasion resistance
- Resistance to corrosion/oxidation and chemical aggression
- Anti-sticking

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**HDP X7**
Composition: Aluminium Chrome Titanium based multilayer
Deposition technology: High Density Plasma

HDP X7’s chemical formulation allows to have a coating with a **hardness of 3000HV** and inert in front of metallization phenomena. High toughness and hardness are the two main characteristics of this new STS coating that protects against abrasion, metallization and thermal fatigue.

**TECHNICAL DATA**
- **Thickness**: 3-6 μm
- **Hardness**: 3000 Hv
- **Friction coeff. against 100 Cr 6**: 0.5
- **Deposition temperature**: 480°C
- **Max working temperature**: 900°C
- **Color**: dark grey

**APPLICATION FIELDS**

**CHARACTERISTICS:**
- High hardness

**BENEFITS:**
- Abrasion resistance

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**WC/C**
Composition: Tungsten Carbide and Carbon
Deposition technology: Magnetron Sputtering

The low friction coefficient of WC/C makes this layer an excellent solution for preventing sticking phenomena such as cold welding. WC/C is successfully applied on all sliding and moving parts in which there are poor lubrication conditions. It is **biocompatible** and suitable for food contact.

**TECHNICAL DATA**
- **Thickness**: 1-4 μm
- **Hardness**: 1300 - 1800 Hv
- **Friction coeff. against 100 Cr 6**: 0.15
- **Deposition temperature**: ≤ 180°C
- **Max working temperature**: 350°C
- **Color**: anthracite

**APPLICATION FIELDS**

**CHARACTERISTICS:**
- Low friction coefficient
- Good chemical inertia
- Good hardness
- Biocompatibility
- Food contact

**BENEFITS:**
- Sliding (particularly indicated on gears)
- Resistance to chemical aggression

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**PLC**
Composition: Me - DLC
Deposition technology: PVD

PLC has a friction coefficient of 0.1 which makes it an excellent anti-friction solution. It can be combined and overlapped on any other STS PVD coating. It’s mainly used in the automatic machines and automotive fields.

**TECHNICAL DATA**
- **Thickness**: 1 μm
- **Hardness**: 1500 Hv
- **Friction coeff. against 100 Cr 6**: 0.1
- **Deposition temperature**: 140 - 480°C
- **Max working temperature**: 300°C
- **Color**: dark grey

**APPLICATION FIELDS**

**CHARACTERISTICS:**
- Low friction coefficient
- Low deposition temperature
- Good hardness

**BENEFITS:**
- Sliding

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**MOVIC**
Composition: MoS2
Deposition technology: Magnetron Sputtering

MOVIC was born in space applications to contain frictions in a vacuum, in dry conditions. It’s successfully employed when the use of traditional lubricants is not allowed (oil, grease, ...). It can be combined with any other coating.

**TECHNICAL DATA**
- **Thickness**: 1 μm
- **Hardness**: / (not applicable)
- **Friction coeff. against 100 Cr 6**: 0.1
- **Deposition temperature**: ≤ 100°C
- **Max working temperature**: 180°C
- **Color**: grey

**APPLICATION FIELDS**

**CHARACTERISTICS:**
- Low friction coefficient
- Low deposition temperature
- Can be combined with harder coatings

**BENEFITS:**
- Sliding (dry and vacuum self-lubricating)
**CrN**

CrN manages to express a considerable hardness. Combined with a very tough structure, it is possible to reproduce layers with much higher thicknesses than any other coating (up to 15 microns). This advantage combined with the excellent corrosion resistance makes it an extraordinary barrier to chemical aggression and oxidation. It is biocompatible and suitable for food contact.

**TECHNICAL DATA**

- **Thickness**: 1-10 μm
- **Hardness**: 1800 Hv
- **Friction coeff. against 100 Cr 6**: 0.5
- **Deposition temperature**: 180° - 480°C
- **Max working temperature**: 750°C
- **Color**: light grey

**APPLICATION FIELDS**

*High thickness version

**CHARACTERISTICS:**
- Good hardness
- Optimal toughness
- Good corrosion resistance
- Low temperature deposition
- High deposition thickness
- Biocompatibility
- Food contact

**BENEFITS:**
- Solution to problems in Hertzian high pressure systems
- High working temperature

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**ZrN**

The main tribological characteristic of Zirconium Nitride or ZrN is chemical inertness. The latter prerogative combined with the pleasant straw yellow coloration makes it a reference for high-level decorative.

**TECHNICAL DATA**

- **Thickness**: 1-4 μm
- **Hardness**: 2200 Hv
- **Friction coeff. against 100 Cr 6**: 0.6
- **Deposition temperature**: 220° - 480°C
- **Max working temperature**: 500°C
- **Color**: golden yellow

**APPLICATION FIELDS**

**CHARACTERISTICS:**
- Chemical inertia
- Discreet hardness
- Biocompatibility
- Food contact

**BENEFITS:**
- Resistance to different kinds of oxidation and corrosive phenomena
- Pleasant color

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**TiN**

Titanium Nitride, better known as TiN, has been present on the market for decades and is still of absolute importance in the panorama of PVD coatings. Its properties combined with the fact that TiN complies with EN 10993 (biocompatibility) and FDA (Food and Drug Administration) standards, explain its success in various fields like health, food, automatic machines and mechanical parts.

**TECHNICAL DATA**

- **Thickness**: 1-4 μm
- **Hardness**: 2200 Hv
- **Friction coeff. against 100 Cr 6**: 0.6
- **Deposition temperature**: 220° - 480°C
- **Max working temperature**: 500°C
- **Color**: golden yellow

**APPLICATION FIELDS**

**CHARACTERISTICS:**
- Good hardness
- Good toughness
- Biocompatibility
- Food contact

**BENEFITS:**
- Wide spectrum coating

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**TiCN**

The TiCN coating was born from an evolutionary study of TiN. The introduction of Carbon has developed a structure which offers 50% more hardness than TiN. TiCN is biocompatible and suitable for food contact.

**TECHNICAL DATA**

- **Thickness**: 2-3 μm
- **Hardness**: 3300 Hv
- **Friction coeff. against 100 Cr 6**: 0.3
- **Deposition temperature**: 480°C
- **Max working temperature**: 500°C
- **Color**: bronze/blue grey

**APPLICATION FIELDS**

**CHARACTERISTICS:**
- High hardness
- Biocompatibility
- Food contact

**BENEFITS:**
- High abrasion resistance

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**CrN**

Composition: Chromium Nitride
Deposition technology: PVD

**EN 1935, EN 10993**

**TiN**

Composition: Titanium Nitride
Deposition technology: PVD

**EN 1935, EN 10993**

**TiCN**

Composition: Titanium CarboNitride
Deposition technology: PVD

**EN 1935, EN 10993**

**CrN**

Composition: Zirconium Nitride
Deposition technology: PVD

**EN 1935, EN 10993**

**APPLICATION FIELDS**

**APPLICATION FIELDS**

**APPLICATION FIELDS**

*Different color version
The need to increase hardness while keeping the corrosion resistance of stainless steels unchanged has led STS to seek alternative solutions to classic PVDs. The process involves a cold carbon-based surface hardening and subsequent deposition of a DLC layer. In this way it’s possible to simultaneously enhance the characteristics of hardness, corrosion resistance and sliding of the entire system.

### Technical Data

| Thickness | 20-30 µm in diffusion + 2-3 µm of coating |
| Hardness | 700-1000 Hv + 2000-2500 Hv |
| Friction coeff. against 100 Cr 6 | 0.1 |
| Deposition temperature | 250°C |
| Max working temperature | 350°C |
| Color | Black |

### Characteristics:

- Low friction coefficient
- Hardness gradient

### Benefits:

- Abrasion resistance
- Sliding
- Anti-sticking
- Resistance to corrosion/oxidation and chemical aggression
- Solution to tribocorrosion/Fretting/Galling phenomena

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To improve the characteristics of hardness, corrosion resistance and sliding of light alloys, STS has developed a combination process of chemical nickel plating with PVD / PaCVD treatments. In this way it’s possible to obtain a “gradient” effect for the hardness and enhance the system characteristics of corrosion resistance and sliding.

### Technical Data

| Thickness | 10-50 µm + 2-4 µm |
| Hardness | 900-1000 Hv + 1500-2500 Hv |
| Friction coeff. against 100 Cr 6 | 0.1-0.5 |
| Deposition temperature | 250-480°C |
| Max working temperature | 350-500°C |
| Color | Depends on the PVD |

### Characteristics:

- Hardness gradient

### Benefits:

- Abrasion resistance
- Resistance to corrosion/oxidation and chemical aggression
- Solution to tribocorrosion/Fretting/Galling phenomena

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Our STS Academy team is dedicated to the continuous training of both internal and external technicians in the field of coatings (specifically PVD / PaCVD).

We organize courses and meetings at the headquarters of our customers, at our service centers or remotely (Webinars).

The guided tour within our production departments offers the advantage of fully appreciating the characteristics of the deposition processes illustrated during the presentations.

Main topics covered in training meetings explore the merits of the coatings’ deposition techniques as well as that of the chemical-physical characteristics of the deposited layers and finish with some “case histories”.

Upon request, more specific and targeted issues related to customers’ needs can be treated. Meetings can be used in quality field as specific training.
STS constantly invests in research, to develop new technologies and equip itself with the most advanced machinery. The aim is one: to offer services and products characterized by great innovation and very high quality standards.

The continuous testing of layers with complex structures allows the company to compete with increasingly performing coatings. STS laboratories have state-of-the-art analysis equipment for understanding the coatings’ structure and tribological characteristics.

STS LAB
inovation

We invest in research to offer you the best.

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The continuous testing of layers with complex structures allows the company to compete with increasingly performing coatings. STS laboratories have state-of-the-art analysis equipment for understanding the coatings’ structure and tribological characteristics.

ELECTRONIC SCANNING MICROSCOPE (SEM/EDS)
NANOINDENTOR
SCRATCH TEST
TRIBOMETER
SALT SPRAY

Our passion towards continuous experimentation of new possibilities has pushed us to create a strong Research and Development department, committed to the constant creation of highly performing products, in line with the increased market expectations.

Aerospace, Automotive, Medical and Food sectors, for example, find in our laboratories answers to problems and restrictions that require continuous innovation. This is the case of coatings aimed at lowering CO2 emissions for the automotive industry or safety of non-contamination in the food and medical fields.

Our Research and Development laboratories are also the ideal place where STS customers can carry out specific failure analysis tests and activate problem solving and dedicated product development processes.

We are therefore constantly able to respond quickly and punctually to market needs, and even become precursors of new technologies. This is possible thanks to our highly equipped laboratories, our deep know-how and close collaboration with the Universities of Brescia, Bologna, Padua and Modena.
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