



PVD, CVD, and DLC COATINGS

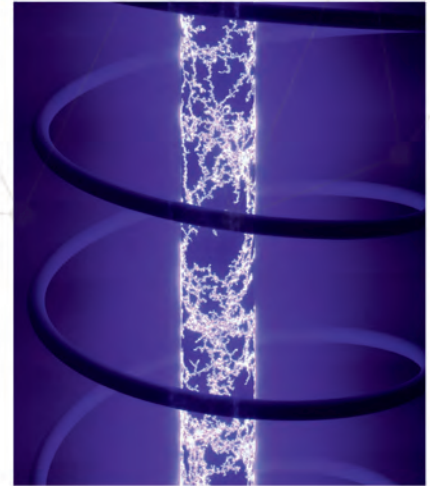
Enhance Product **FUNCTION,**
DURABILITY & COLOR



What is PVD coating?

The **Physical Vapor Deposition (PVD)** process takes a solid metal, vaporizes it in a vacuum, and deposits that vapor, atom-by-atom, onto the surface of a part. This process forms a thin, bonded metal layer that improves the appearance, durability, and/or function of a part or product.

During deposition, metal can also be reacted with nitrogen, oxygen, or carbon gas to form compound materials such as



Chromium Nitride (CrN)—chromium metal reacted with nitrogen. These compound materials can be customized to change the color or durability of a coating.

Plasma enhanced chemical vapor deposition (PE-CVD) is another thin-film process that energizes atoms in a gas and deposits them on a surface.

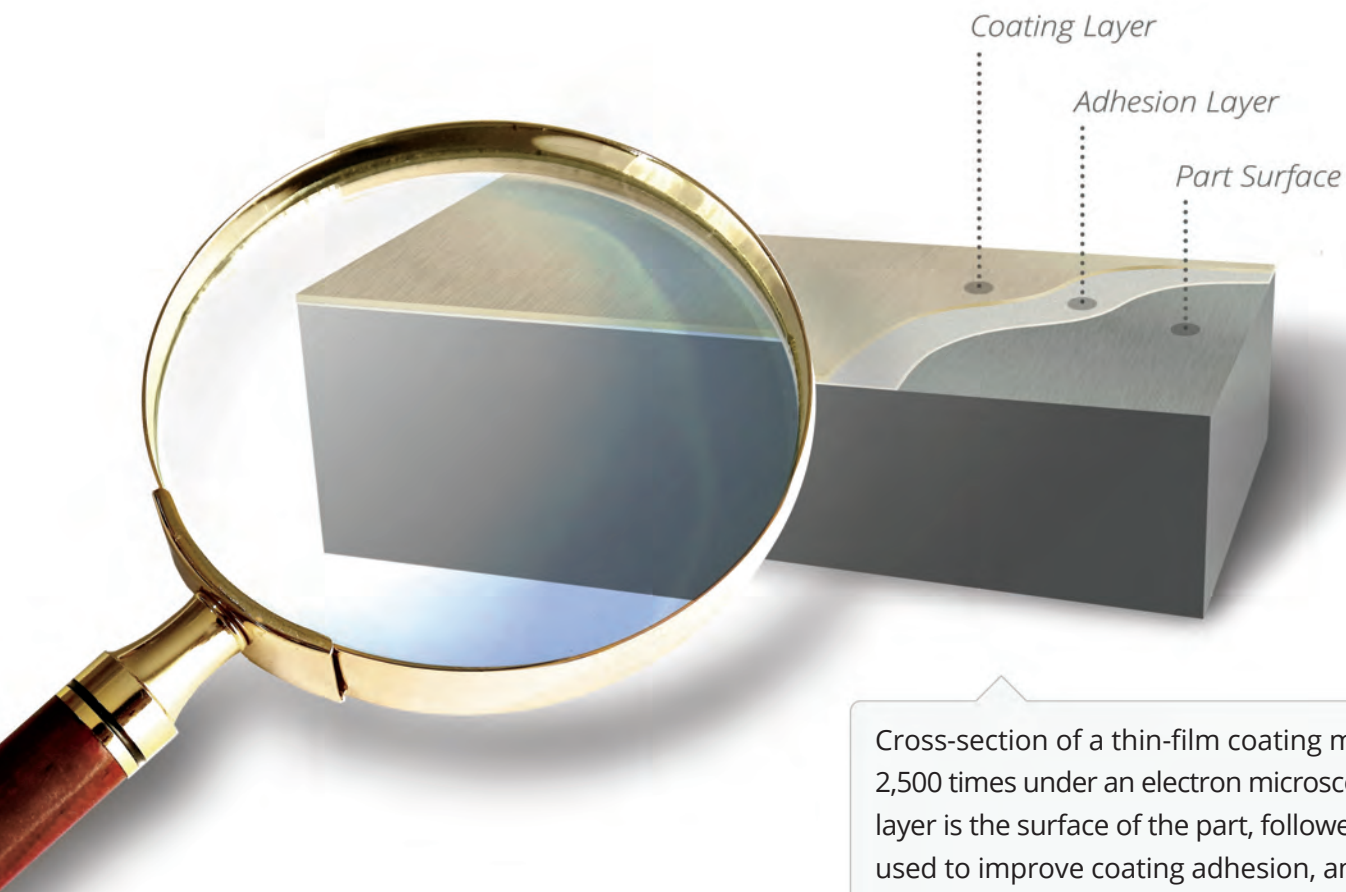
Diamond-like carbon (DLC) coatings are applied via the CVD process.

Note that despite distinct differences, common terminology refers to all three types of coatings as “PVD Coatings.” To avoid confusion, this document refers to all vapor-deposited finishes more broadly as “thin-film coatings.”



What do thin-film coatings look like?

Thin-film coatings are typically 0.25 to 10 microns thick. They add almost no additional mass to a part or product.



Cross-section of a thin-film coating magnified 2,500 times under an electron microscope. The bottom layer is the surface of the part, followed by a thin layer used to improve coating adhesion, and finally the coating itself (the new durable surface of the part).



How do thin-film coatings compare?

Thin-Film Coatings:

Thin-film advantages for manufacturers

- **Extremely thin**—Perfect for high tolerance parts.
- **Durable**—Scratch and wear resistant, multiple times the hardness of hardened steel and extremely wear-resistant.
- **Improved appearance**—Improve both durability and appearance with a broad range of metallic colors as well as a dark black.
- **Flexibility**—Low-temperature thin-film process coats hardened metal and even plastic parts without softening.
- **Waste Reduction**—Thin-film coating equipment generates no hazardous waste.

Thin film compared to powder coating

- Significantly harder and more resistant to wear.
- More than 50 times thinner than typical powder-coated finish.
- Metal-based versus an organic polymer.

Thin film compared to electroplating

- Harder and more wear-resistant.
- Broader range of metallic colors.
- Does not require the use of acids, cyanides, or hexavalent chrome.
- May be deposited over an electroplated base layer to improve wear resistance or appearance.

Description

Benefits

Characteristics

Applications

Optimization

Coatings



Which One is Right for You?

VT-Decorative™ **Durable Color Coatings**

VaporTech VT-Decorative Color finishes are custom-designed to improve both product appearance and durability. The patented VaporTech low-temperature arc vapor deposition (LTAVD®) process enables manufacturers to apply finishes to most metals and many plastics.

Decorative coatings improve the look, durability, differentiation, and value of products.

VT-Decorative coatings are available in a broad range of decorative colors with excellent durability.

Home hardware, plumbing products, automotive trim, personal electronics, sporting goods, firearms, and jewelry.

Coating and process customized to meet your specific requirements for coating both metal and plastic parts.

Brass, gold, copper, light bronze, dark bronze, oil-rubbed bronze, nickel, stainless steel, silver, gray, black, blue-black, vivid blue, cool gray, and chrome.

VT-Functional™ **Tribological Coatings**

VaporTech VT-Functional PVD coatings are designed to make your product last longer, operate more efficiently due to lower friction, withstand high temperatures, and resist corrosion. This improved durability comes from a coating only microns thick, suitable for even the highest tolerance parts.

Improves the hardness and durability of even the hardest, heat-treated steel.

VT-Functional coatings are not just metal, but rather materials made by reacting chromium, titanium, zirconium, or other metals with oxygen, nitrogen, or carbon.

Machine tooling, engine and chassis components, cutting tools, and medical devices.

Coating and process customized to meet your specific functional requirements.

Chromium nitride, zirconium nitride, titanium nitride, titanium carbide, titanium carbonitride, titanium aluminum nitride, and others.

VT-Diamond™ **DLC Coatings**

VaporTech VT-Diamond coatings are diamond-like carbon (DLC) thin-film coatings applied through either a physical or chemical vapor deposition process.

The unique VaporTech plasma-enhanced chemical vapor deposition DLC process can coat complex geometries.

A VT-Diamond coating maximizes durability, reduces friction, and improves product appearance and value.

Machine tooling, engine components, aviation, cutting tools, medical devices, and high-value consumer products.

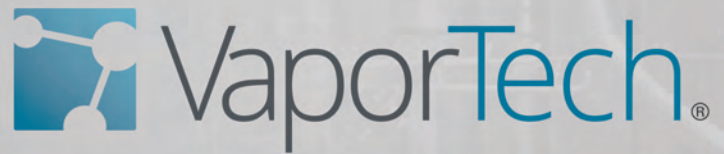
Coating and process customized to meet your specific functional and aesthetic requirements.

Wide range of diamond/graphite variations to meet specific needs. DLC coatings are usually a dark gray color.

Vapor Technologies (VaporTech) manufactures thin-film coating equipment and develops custom coatings (PVD, CVD, and DLC) to use with our systems. We are located in Longmont, Colorado, and have been serving clients worldwide for more than two decades.

Learn more today!

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