About PVD Titanium Color Coating

Overview:
Rather than simply applying a layer of different colorful substances and simple gold plating on the metal instruments, the craftsmen acquired a process that would guarantee long-term resistance after testing various techniques. Finally they chose an effective procedure: PVD (Physical Vapor Deposition), which involves coating the surfaces with a layer of protective metallic vapors (Ionic plating).

How it Works:
The instruments to be treated are placed on supports in an air-tight container, which may hold several hundred parts at a time. The air is pumped out of the container, creating a vacuum equivalent to one billionth of normal atmospheric pressure, in other words close to the pressure that exists in space. A flow of gases, ionized Nitrogen and Argon is introduced into the chamber. These ionized particles are sprayed on to the instruments, which causes their surface to heat up. Deposition material Titanium is flash evaporated and ionized by an electric arc. This generates a plasma within the chamber of ionized atomic Nitrogen, Argon and Titanium. A voltage is applied to the substrates to accelerate the ions in the plasma cloud to the surface of the parts. This positively charged Titanium plasma is attracted to the negatively charged parts to be coated. The Titanium and Nitrogen combine on the surface of the substrate, Ion by Ion, forming a dense, hard coating of Titanium Nitride (TiN). The coating bonds to the surface of the substrate, and even penetrates the surface slightly, to give an outstanding level of adhesion.

For Gold Coating:
For Gold Coating, the layer of titanium nitride is then covered with a layer of 23 carat gold to enhance its beauty.

For Colour Coating:
For Colour Coating, a special desired color formatting substance is applied to create the formation of thin layer of color (Blue, Black, Rainbow etc).

The coating cycle lasts several hours. All process variables are carefully controlled to insure a high quality coating. Each coating batch is tested for quality, thickness, and uniformity before being passed.

In this whole process Titanium Nitrate plays the major role. It is an extremely dense, compact and a highly resistant substrate.

Today, Both manufacturing and designing engineers recognize the benefits of thin-film coated products. By applying a carefully selected 3 ~ 5 micron coating on tools, tool life can be increase, from 50% to 500% longer.

PVD coating on Multiplex Traders tools is a layer of Titanium Nitride embellished with perfection, attained by experience. Our customers will benefit from our experience with the application of thin-film PVD coatings on our tools.

It may also be mentioned that Physical Vapor Deposition is not harmful to the environment since it is a procedure that produces no pollutants, neither directly nor in the form of toxic residues.

Physical Properties of Titanium Nitride (TiN) Coatings

Composition	TiN. > 99 % purity.
Process	PVD Vacuum Deposited Coating.
Appearance	Metallic Gold.
Thickness	Ranges from 0.25 to 12 microns. Typical applications are 1 to 5 microns. See the thickness conversion chart.
Uniformity	Coating conforms uniformly to the substrate. No buildup occurs on corners (unlike plating operations). Coating "throws" well into features. In deep holes, coating tapers off from 1 to 7 diameters of depth.
Hardness	Hardness > 2000 kg/mm2 Knoop or Vickers Microhardness. Values of 2500-3000 are typical. Equivalent to over 85 Rc. Three times harder than hard chrome and harder than carbide material.
Adhesion	The coating forms a metallurgical bond to the substrate that will not flake, blister, chip or peel. In fact, the coating is actually implanted slightly into the surface layer of the substrate. Adhesion is superior to plating and other coating processes where mechanical adhesion occurs. Several adhesion test methods are possible, contact BryCoat for more info.
Adhesion, Scratch Adhesion Value	> 3.0 kgf on hard steel substrates
Coefficient of Friction	TiN generally provides low friction against steels, carbides, TiN, ceramics, platings, etc. Published values range from 0.05 to 0.90. A typical value is 0.6 for TiN against steel. The inert surface creates outstanding sliding wear performance. **Note:** The coefficient of friction is a system property, not a material property. It is dependant on many factors such as material, counter-material, lubrication, temperature, speed, loading force, surface finish, surface finish of the counter-material, and type of motion (reciprocating, rotating). Published values can have large variations.
Non-stick	TiN is an excellent non-stick surface against most other materials.
Toxicity	Non-toxic. Meets FDA guidelines and has been approved for use in numerous medical/surgical devices, including implants. Meets requirements of FDA and USDA for food contact.
Temperature Resistance	Begins to oxidize at 600 C. (1100 F.) in air. More resistant in an inert atmosphere.
Melting Temperature	2950 C.
Deposition Temperature	Ranges from 200 to 450 C. Standard process is 400 C. and provides the toughest coating. See also the temperature reference page.
Electrical Resistivity	25 Ohm-cm. To determine resistance, multiply by length and divide by cross sectional area.

Chemical Resistance	Highly inert to acids, bases, solvents, caustic, etc.
Thermal Expansion Coefficient	9.4 x 10-6 /C.
Thermal Conductivity	0.046 Cal/sec.-cm-C.
Density	5.22 g/cm3.
Crystal Structure	Face Centered Cubic.
Residual Compressive Stress	xxx
Young's Modulus, Modulus of Elasticity	600 GPa.
Poisson's Ratio	0.25
Heat of Formation	80,750 Cal/mole. (3.5 eV/molecule).
Band Gap	3.35 - 3.45 eV