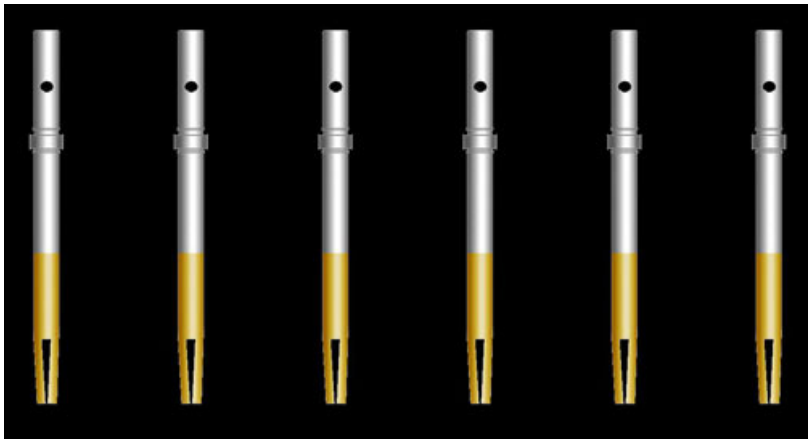
An Overview of
Gold Plating & Selective Gold Plating

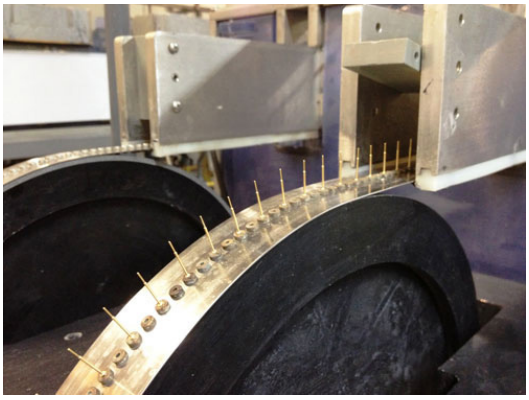
Introduction

Metal finishing is essential to product performance and product design, but how do you decide what finishing material to use? Plating is the most common manufacturing finishing procedure and can impart many advantageous characteristics. The type of material and the application along with the thickness of the finish must be taken into consideration when choosing the best process. High quality plated at the proper thickness can make the difference between a competitive product and a lost opportunity. Why is metal finishing so widespread? Many products made from metal would last only a small portion of their present existence because of corrosion and wear. Finishing is also used to improve electrical characteristics, to form and shape components, and to increase the bonding of adhesives or organic coatings. Finishes are also used to meet a customer's requirement for a more cosmetic appearance.

Gold is considered the ultimate precious metal for processes like electrical contact plating. Gold is used extensively for electrical component applications such as switches, sensors, electrical contacts, connector pins, and a number of others. Gold does not form surface oxides, conducts low voltage currents for long periods of time without corrosion or failure and provides good wear resistance, especially when combined with cobalt or nickel.



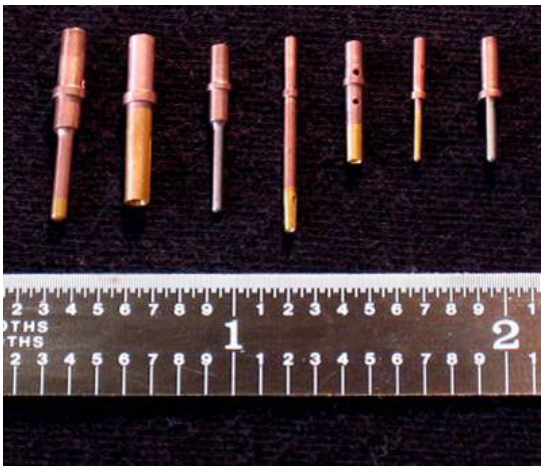
Plating Processes



One method that is commonly used is electroplating. The process used in electroplating is called electro-deposition. Electroplating is accomplished by passing an electric current through a solution that contains dissolved metal ions as well as the metal object that needs to be plated. The metal object attracts ions from the solution, serving as the cathode in an electrochemical cell. Ferrous and non-ferrous metal objects are plated with a variety of metals including Gold, Silver, Nickel, Electroless Nickel, Copper, Palladium, Tin, Tri-M3 (tri-metal alloy). This is regulated by controlling a variety of conditions including voltage and amperage, temperature, time in the solution and the purity of bath solutions. Plating baths are usually aqueous solutions, and consequently only those metals that can be reduced in aqueous solutions can be electrodeposited. The main exception to this principle is aluminum, which is able be plated from organic electrolytes.

Electroless plating, on the other hand, is in autocatalytic chemical process. Electroless plating is the chemical deposition of a metal coating onto an object using chemical reactions as opposed to electricity. The basic ingredients in an electroless plating solution includes a source metal, a reducer, an agent for holding the metal in solution, and a variety of buffers and chemicals designed to maintain bath stability and to increase bath life. Printed circuit boards often require copper and nickel electroless plating.

Gold Plating Considerations



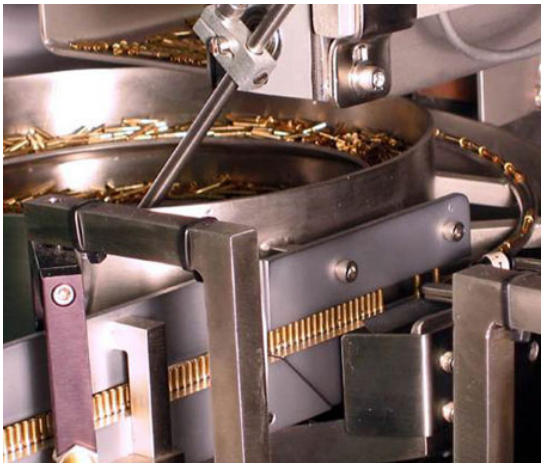
Gold plating is a process of placing a thin layer of gold on the surface of glass or metal, most often; Copper or Copper Alloy, Phosphorous Bronze, Steel, Stainless Steel just to name a few. Gold plating is used in many applications, including electronics, to provide an electrically conductive and corrosion-resistant layer on copper and electrical connectors.

When copper is gold plated, it's important to avoid tarnishing of the substrate prior to plating. Tarnishing can most easily be resolved by prior deposition with a nickel strike. This consists of special plating deposit called a "strike" or "flash" and is used to form a very thin plating layer with high quality and good adherence to the substrate. This serves as a foundation for later plating processes. A strike uses a high current density and a bath with a low ion concentration. More efficient plating processes are generally used once the required strike thickness is obtained since this is a slow process.

The hardness and purity of the gold must also be considered when determining factors such as optimal bath mixture and length of immersion.
Hard gold is an alloy of 99.7% gold and 0.3% hardening agent, which is usually nickel or cobalt. Gold plating does not oxidize or chemically react in corrosive environments, making it perfect as an electrical or electronic contact finish. Hard gold is used where electrical conductivity, solderability and corrosion resistance are important requirements. Hard gold proves superior contact wear resistance when compared to soft gold.

Pure gold is naturally soft because it is absent most additives and grain refiners that make the deposit hard. Soft gold is 99.9% pure gold, increasing its elasticity and is solderability. Soft gold is typically used in applications such as lead frame wire bonding applications and high reliability solder applications where hard gold would be less appropriate.

Selective Gold Plating



A more precise process, selective gold plating was first developed for telecommunication applications in to reduce gold consumption and cost while still maintaining performance and functionality. Due to its price, it has always been important to deposit gold only in those areas and at such thickness as the application actually requires. Therefore, selective techniques for gold deposition were developed quite early, and are constantly being improved.

Selective gold plating processes allow gold to be deposited on the end of a pin or contact with as much as 5 microns (.000200") of gold, while leaving the rest of the pin nickel plated or with as little as .125 microns (.000005") of gold. Using these methods can achieve as much as a 70% savings in material.

Precision fluid level monitoring of the plating cells is used to create controlled depth replication to within .022". The design of flexible tooling and transport belts permits a wide range of controlled depth plated part arrangements through the conveyor system and pin carriers. By using particular inserts, parts can be plated up to 1.75" in length and .25" in diameter.

Conclusion

In conclusion, precious metal plating, particularly gold had found a niche is modern electronics equipment due to its unique properties, therefore methods to efficiently deposit it on substrates has become a priority due to its cost. Additionally, faster automated equipment will become more prevalent as the need for more types of products are introduced to the marketplace.