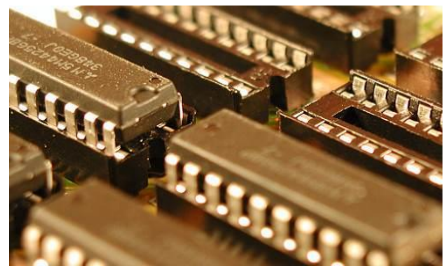
Solderable Gold Plating of Electrical Contacts

Gold has and continues to be a principle finish for electrical components especially with the continuing miniaturization of electronics. One of the primary benefits of gold plating services is a finish that is both conductive and receptive to soldering. When soldering gold plated components there are a variety of important considerations when specified the surface finish. The primary considerations are thickness, purity and the proper selection of an underplate.

Plating Thickness



Gold plating thickness is a critical, and often misunderstood, tenant of gold soldering. In gold soldering the physical bond is made between the underlying nickel layer and the solder itself, with the gold layer serving as barrier to help maintain the solderability of the nickel layer. Typical gold thickness for solderability is in the range of 10uin to 30uin as it provides adequate protection against oxidation to preserve wetting while keeping the cost of the finish as competitive as possible.

When soldering, gold dissolves into the solder through solid state diffusion. With heavier gold deposits, more gold alloys within the solder joint. In the diffusion process the gold reacts with the solder creating a gold intermetallic amalgam. If the gold in the solder exceeds 3% by mass, the solder joint can become embrittled causing joint failure, especially in dynamically or thermally stressed joints. The level of impurity and thickness of gold are directly related, thus thickness of the gold must be balanced between corrosion/oxidation protection, contact cycle life and solderability. (Soldering to Gold – A practical Guide).

Purity

Purity of both the gold and underplate layers is critical to achieve the best solderability. For gold plating there is an importance to minimize organic impurities through proper tank maintenance. Organic impurities that are imparted into the plating layer can interfere with the soldering and can cause dewetting or voids in the solder. Soft gold of 99.9% purity is typically the preferred gold for

bonding or soldering applications. However, nickel or cobalt hardened gold can solder well and provide improved wear resistance on contact surfaces. However, the purity of the hard gold needs to be preserved through proper analytical work and tank maintenance.

Nickel purity is critical as this layer is the functional bonding layer. For nickel soldering the higher purity nickel the better the soldering. Often plating companies use an organically brightened nickel layer such as a brightened Watts or sulfate-based nickel to give a bright finish at the expense of solderability. Advanced Plating Technologies offers an engineered sulfamate nickel-plating layer recommended as an underplate for gold plating including soldering applications. This nickel system is free of codeposited organics that can outgas or volatilize during soldering thereby causing voids in the solder joint.

Another common underplate for gold plating is electroless nickel. While there are many advantages to electroless nickel plating including hold tight tolerances, large deposit range, corrosion protection, lubricity - one issue is that phosphorus is deposited in conjunction with nickel on the surface. The phosphorous acts as an impurity in soldering and can impedes soldering. When specifying electroless nickel deposits a medium phosphorous electroless nickel can give you the balance of the positives of electroless nickel while preserving solderability.

Solder Process

When designing a solder process for gold plated parts it is important to remember that the solder joint forms between the solder and the nickel. Therefore, when performing multiple solder operations or reflow soldering, additional liquidous time must be allotted for to provide ample time for the solder to bond to the nickel. In addition, typically a rosin-only flux is needed when soldering to gold plating. However, for very thin gold deposits that are significantly aged, a rosin mildly activated (RMA) flux can help with removing any nickel oxides that may have propagated through the gold layer to the surface.

Conclusion

Soldering to gold plating is becoming more and more prevalent with the rise in high-end microelectronics. More than ever it is important to understand the process of soldering to gold and designing surface finishes to provide the most robust, cost effective finish. The proper gold finish must balance corrosion and wear performance with solderability to ensure the best possible design. A member of Advanced Plating Technologies technical sales staff can assist with designing a finish the meets the specific design requirements of your application.

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References:

1. *Ronald A. Bulwith ; Soldering to Gold – A Practical Guide*