

Electroplating Solutions Improves Connectors

By Dave Miller, Vice President of Sales – Precious Plate, Inc.

A method to continuously spot plate tin/lead deposits onto restricted areas of a connector is available. The primary purpose of all connector systems is to establish a connection between two independent circuits while minimizing signal distortion and power loss. The function of electroplating in these connector systems is to protect the contact base material from corrosion and wear, thus optimizing the contact interface. With today's high-speed, high-frequency, low-voltage connectors, plating is critical in maintaining interface integrity.

A typical plating specification consists of a precious metal topcoat (on the contact interface), a nickel undercoat and a tin/lead finish (on the termination end). The topcoat is typically gold, palladium or palladium/nickel. The function of a topcoat is to provide an oxide-free connection interface that maintains a durable, corrosion-free surface. The undercoat is typically nickel, which improves durability, provides a diffusion barrier for migrating base material elements and reduces sensitivity to porosity. Tin and tin/lead are typical plating finishes on the termination end of the connector. They provide a high-quality solderable finish and have lubricating properties that facilitate pin-to-board insertion.

Electrodeposition Techniques

As connectors have become increasingly smaller and denser, new problems have developed with using typical plating methods. Connector plating companies have had to design a plating method that applies the finishes in a selective manner.

Typical selective plating techniques used in connector plating are controlled-depth, brush, stripe and spot plating. Stripe and spot plating are the predominant methods. Although these methods require more engineering expertise in equipment design and process development, they have proven to be more effective than controlled-depth or brush plating.

Stripe plating has been used extensively for both precious metal and recently tin and tin/lead plating. This method involves the use of continuous belts to mask the areas of the contact that should remain unplated.

Spot plating has been used predominantly to apply precious metals (the topcoat) to the contact interface. This method not only conserves precious metals but also precisely places the deposit to optimize performance. Spot plating requires tooling designed and built specifically for a particular connector part. The tooling operates on plating equipment that is much more sophisticated than standard plating machines.

Stripe plating has proven to be inadequate to keep pace with advancements in connector molding technology. To insulate contacts from one another, a plastic molded housing must be formed around the contact group. Advancements in molding technology have led to high-speed, continuous, reel-to-reel overmolding of contact groups. This has created new challenges for the selective plating of tin/lead.

An Overmolding Problem

Many connector manufacturers require more selectivity for tin and tin/lead plating; on one particular product, tin/lead was being deposited using stripe plating. Because of the limitations with stripe plating, tin/lead was being applied in areas of the part other than where it was absolutely needed. As a result, serious problems were encountered.

After the stripe plating, the part goes through a continuous polymer overmolding process. During this process, liquid crystal polymer (LCP) is continuously overmolded on the part. With stripe plating, tin/lead is inadvertently deposited in areas where plating is not required. This results in LCP actually being molded over the tin/lead deposits. LCP reaches temperatures in excess of 500°F and at this temperature, the melting point of tin/lead is exceeded. The tin/lead then melts, reflows and runs off the part into the mold cavity. Once in the mold cavity, the tin/lead resolidifies and becomes what is commonly referred to as "mold debris."

This mold debris manifests itself as particles and lumps of tin/lead in the mold cavity. As the plastic housing was molded around the contact group, voids were discovered in the housing that were caused by the lumps in the mold cavity. As the mold continues to be used, these lumps get larger and more frequent, rendering the overmolded parts unacceptable. This results in shut downs to clean the mold, which reduces efficiency and increases production cost.

After overmolding, the next step is to assemble the overmolded parts into connectors. During this process, the parts are separated, stacked and assembled into connector housings. Evidence showed that the tin/lead particles found in the molds were being transferred from the molds to the assembled connectors. These pieces of tin/lead, being

conductive, have the potential to create electrical shorts in a connector, which is an important quality concern. The tin/lead particles are hard to detect and hard to remove, which further complicates the situation.

Cost-Effective Plating Technology

As a solution, a method was developed to continuously spot plate tin/lead deposits onto restricted areas of a connector. The tin/lead is completely removed from the overmolded area, which eliminates the possibility of reflow. Delivering it to the part using a specially designed belt controls the plating. Part-specific tooling is synchronized with the strip and exposes only the area of the part where tin/lead plating is required. With continuous spot plating, the deposits are applied while the strip is moving through the plating line, without stopping.

Testing was coordinated with all manufacturing companies involved. After testing and examination it was evident that spot plating the tin lead deposit was an effective method for solving this particular problem.

Continuous spot plating of tin/lead deposits onto small areas created some challenges. Spot plating must be carried out under high plating solution flow. Unlike precious metals, tin/lead has a tendency to oxidize and "sludge out" under these conditions. As tin begins to sludge out, it will clog solution flow areas. However, some innovative equipment and process designs have been developed to overcome this problem.

Conclusion

The technology of spot plating precious metals has been adapted to continuously spot plate tin/lead deposits onto connectors in an economical fashion. This method addresses a major concern of connector manufacturers, and helps connector plating companies, like Precious Plate, keep pace with the rapid move toward device miniaturization.



www.preciousplate.com