

Leveraging Reel-to-Reel Plating Early in the Design and Production Planning Process

Design for Manufacturing (DFM) disciplines should consider plating alternatives to assure production efficiency and cost optimization.

Electroplating of components is an integral element for many of today's product designs, with the selective application of precious and non-precious metals now a routinely specified requirement. However, the plating process should not be simply considered a routine afterthought when it comes to optimizing product design for manufacturability.

This Tech Bulletin provides an overview of reel-to-reel plating technology and identifies key considerations regarding different plating methods to meet design and production objectives.

Topics addressed in this Tech Bulletin include:

- Pre-Plating vs. Post-Plating tradeoffs
- Overall full-coverage plating
- Controlled Depth plating
- Selective Stripe plating
- Selective Spot plating
- Selective Brush plating
- DFM best practices

Overview of Reel-to-Reel plating

Over recent years, continuous reel-to-reel plating has proven to offer significantly better control over the process, with more consistent yields and quality than other alternatives, such as barrel or rack plating.



For example, the tumbling methods used in barrel plating are inherently variable with regard to thickness and coverage, which often requires small-batch sizes and/or high scrap levels to achieve yields and reduce the potential for damaged product. In addition, for selective plating requirements, parts must be individually masked before rack plating, which adds time and cost for these labor intensive secondary process steps. If parts have been singulated prior to the plating process, the only alternatives for post plating are to barrel plate them or use some other secondary method, such as a manually racking, to present them uniformly for plating.

In contrast, reel-to-reel plating of continuously formed parts offers the inherent advantage of all the parts being uniformly presented to the plating process, which enables much greater precision and consistency as well as the ability to integrate a range of selective plating options within a single pass plating process.

Pre-Plating vs. Post-Plating Tradeoffs

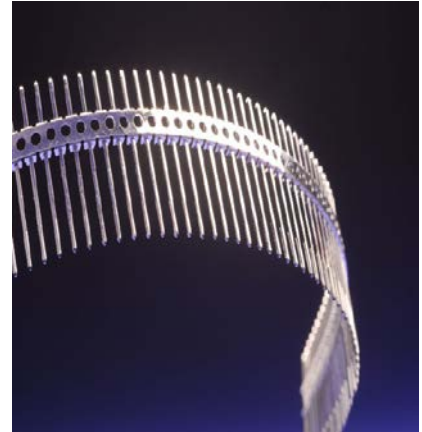
The first consideration in Design for Manufacturing is whether to use pre-plated strip material (before final part formation) or post-plating (after final part formation). The primary tradeoff is cost vs. coverage.

If a material is first pre-plated and then stamped, the exposed edges from the stamping process will not be plated. In contrast, post-plating after all stamping and part-formation will result in full 4-sided coverage. For those applications in which bare edges are not a problem, processing costs can typically be reduced by utilizing pre-plated materials.

Overall Plating vs. Selective Plating

The second consideration is whether or not the parts should be selectively plated or can be fully plated. Overall plating (such as the parts shown at right) typically involves less preparation and process control factors so the process is more straightforward.

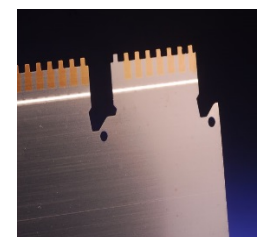
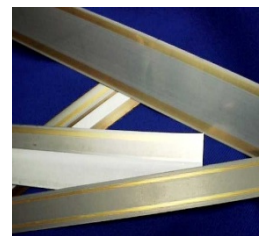
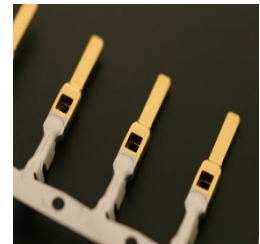
However, due to high cost of many precious metal plating finishes, such as gold, palladium, silver, etc., it can often be advantageous to use selective plating processes to minimize the amount and cost of the precious metal.



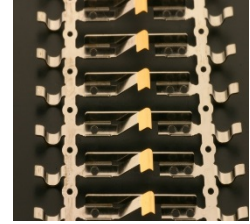
Types of Selective Plating

The following sections provide a brief synopsis of various selective plating processes along with their typical usage scenarios and advantages.

- **Controlled Depth Plating** – provides a method for plating coverage around the complete circumference of selected component features, such as leads or contact points. The controlled depth process can be accurately controlled for acceptable results with no special tooling or masking required.
- **Selective Stripe Plating** – provides a highly efficient method for plating a specific area of coverage across a series of reeled parts or flat coil stock. Depending on the circumstances, selective stripe plating can be incorporated into either pre or post forming processes.
- **Selective Spot Plating** – provides a very precise method for targeting the plating process only to specific areas of each part, thereby minimizing the amount of plating material required. Selective spot plating can be very useful to minimize costs in applications that require precious metal plating but only need coverage on very specific contact or wire bond locations.



- **Selective Brush Plating** – provides a cost effective method of applying selective plating to continuously reeled parts using a brushing method. Brush plating is typically a post-stamping process and can be very cost effective for plating of specific features such as the raised contact areas shown at right.



Materials Considerations

Reel-to-reel plating processes are compatible with a wide range of finishes, including these precious and non-precious metals:

- **Precious Metals**
 - Gold – Hard (Co & Ni hardened) and Soft
 - Pure Palladium
 - Silver
 - Wire Bondable Gold and Palladium
- **Non Precious Metals**
 - Copper
 - Nickel
 - RoHS Compliant Tin (whisker mitigating)
 - Tin Lead (95/5, 93/7, 90/10, 60/40) Matte & Bright finishes
 - Wire Bondable Nickel Phosphorus
 - Tin Silver

Based on several studies, Nickel Phosphorus with a Gold flash seems to be a good contact material for applications where Nickel / Gold plating is normally used and where the main requirements are resistance against wear and corrosion.

The properties and corrosion resistance of electroplated NiP / Au can double the life of a contact for the same thickness of Gold. The gold plating thickness compared to a classical nickel under-layer (matte or bright) can be reduced by a factor of two.

DFM Best Practices

The biggest mistake that companies can make is getting too far down the product design process before involving people with expertise in plating processes and alternatives. Up front involvement of plating experts can assure manufacturability and keep down costs – both by minimizing the amount of precious metal in each product and streamlining production sequence to avoid unnecessary steps.

Best practices in Design for Manufacturing call for early consultations with all of the key manufacturing participants to assure that production process choices reflect both the product specifications and the need for optimal production efficiency.

In many cases, the relatively small investment upfront for choosing the optimal reel-to-reel plating methodology can yield huge cost savings over the lifecycle of a product.

More information regarding reel-to-reel electroplating technologies can be found on the web by visiting www.interplex.com/plating or by contacting Rob Souza at (401) 434-6543 extension 378 or by email at rob.souza@us.interplex.com.