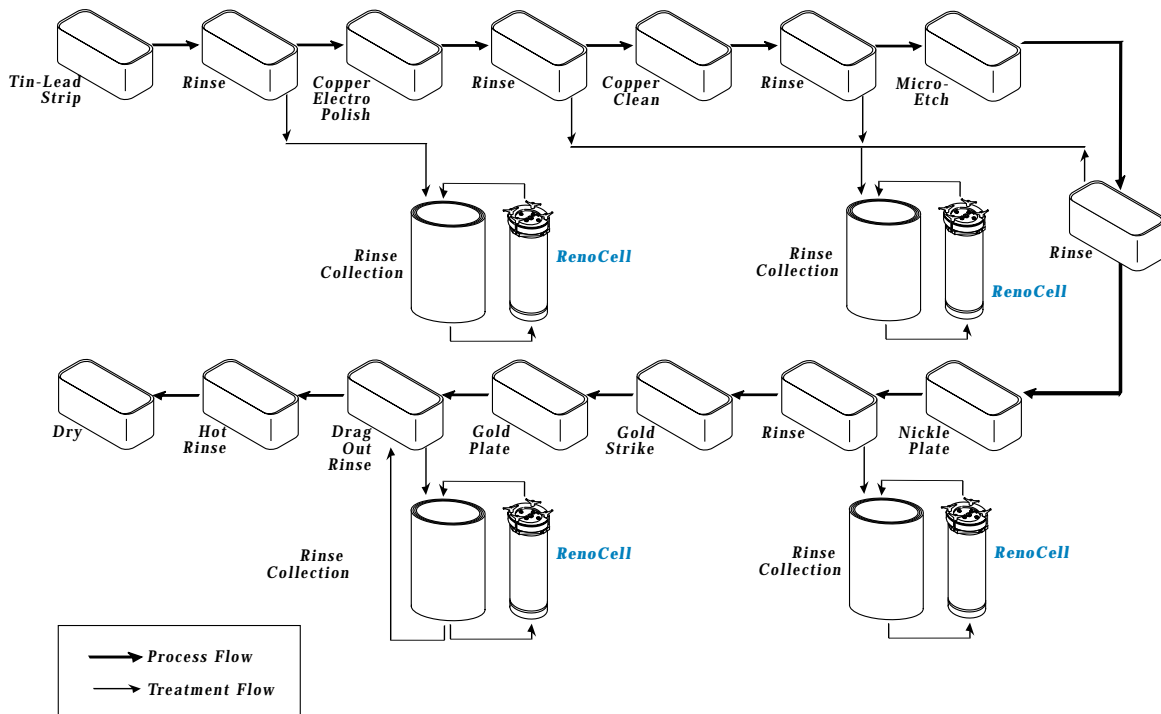


Nickel/Gold Tab Plating Line



Introduction

The conducting circuitry of a PCB contains copper as the most prevalent conductor along with the lesser use of Nickel, Silver, Tin, Tin-Lead, and Gold as etch-resists or top-level metals. RenoCell electrodeposition technology has proven applications in removing these metals from process rinse waters.

PCB manufacturing involves over 50 different process steps. Subtractive processing involves the selective removal of Copper. Initially, a Photo-sensitive resist material is transferred to the virgin Copper surface and the circuit patterns are exposed to UV

light, and the circuit pattern is developed. The remaining unwanted exposed Copper surface is then etched away by chemicals and rinsed with water.

The image material is then removed and a final protective Solder resist is applied. Plated Through Hole PCBs require the selective deposition of Copper and tin or Tin-Lead on an image formed in a similar way. The Plating Resist forms the circuit pattern and, on its removal after plating, the Etch Resist (the Tin or Tin-Lead) protects the circuit during etching of the newly exposed substrate Copper. Subsequent similar processes

selectively plate Nickel and Gold on the edge contacts of the circuit.

RenoCell technology focuses on the removal of metals from these complex chemistries and provides for waste minimization and continued reuse of the rinse waters.

RenoCell addresses the important management issues of:

- Increasing process and water treatment costs
- More stringent metal compliance levels associated with effluent regulations
- Varying volumes of, and concentrations in, metal contaminated water rinses

- Reclamation of Gold, Silver, Palladium and other precious metals

Economic and Environmental Benefits

PCB process lines include concentrated chemistries for cleaning, etching, electroplating, and stripping each, followed by rinsing process steps. RenoCell provides PCB manufacturers with several major benefits:

- Virtual removal of all metal to allow rinse water reuse, saving more than 40% in overall treatment cost
- Total operational cost savings of 70% over conventional treatment methods

- Lower initial capital costs with faster payback periods
- Reduced wastewater loading on existing waste treatment facilities
- Conformance with federal and local discharge compliance standards

Implications of RenoCell Application to Nickel/Gold Tab Plating Line

A typical Tab Connector Plating Line only immerses a small portion of the board in the solution chemistries. The PCB proceeds sequentially through the tin lead stripper etch, Copper electro-polish, cleaner, and micro-etch chemistries followed in line by Nickel plate, Gold strike and Gold electroplate which completes the process. While less metal is generated in this process, the value of recovered gold and nickel significantly reduces overall process costs.

A specific nickel/gold tab line was referenced to gather typical PCB volumes, values, and other key parameters. The following assumptions were established.

Nickel/Gold Tab Plating Line Assumptions:

- 30-60 panels/hour
- Utilizes 10% PCB immersion
- 0.0048 drag out ratio
- 6 liters water/rinse and 12 rinses/hour
- Line operates 24 hours/day, 6 days/week, 50 weeks/year

Tin-Lead Strip Rinse Water

The rinse of the solder-mask-over-bare-copper surface finish method (SMOBC) has made Tin-Lead plating unnecessary for most panels. Lead on the panel surface is a major source of waste Lead in the process fluid. Lead concentrations are 50 grams per liter and Tin concentrations 50 grams per liter. RenoCell removes approximately 340 pounds each of Tin and Lead per year from rinse waters after the tin-lead strip sequence.

Copper Electro-polish and Micro-Etch Rinse Waters

This sequence is a significant source of Copper contamination in process fluids and rinses. Micro-etch strip

etch Copper concentrations of 25 grams per liter is used with this line process. The rinse water cycles after this sequence generate approximately 165 pounds of Copper per year.

Gold Plate Drag-out Rinse Water

Nickel/Gold finishes may be selectively plated onto certain areas of a circuit. The most common application of hard Gold is onto edge connectors. Here the panel is process through a Nickel/Gold plating line with just the edge connector immersed in the plating fluid. Gold concentration of 5 grams per liter and Nickel concentration of 50 grams per liter is used with these process sequences. RenoCell recovers approximately 35 pounds of gold and 335 pounds of nickel from rinse waters after the Nickel/Gold electrolytic strike and plate sequence.

Conclusion

The value of the Gold and Nickel recovered more than offsets the cost of RenoCell treatment for the entire Nickel/Gold Tab plating line PCB process. There is a one-year initial payback of capital equipment costs. With respect

to high value metals such as Gold and Nickel, the value of the metal recovered more than offsets the annual operating costs attributable to RenoCell. The value of the Gold and Nickel recovered can also be applied to the capital and operating costs of utilizing RenoCell source treatment in other parts of the PCB operation. When RenoCell is used as a source treatment, metal-bearing sludges are not generated, eliminating the costs and liabilities of handling and treating these hazardous sludges.

Gold carried into the drag-out is removed, giving concentrations at discharge from the RenoCell of 0.1 ppm (mg/L). This reclaim effectively provides a major source of income which helps to fund the removal of Copper from other rinse sources and render Tab Plater discharges suitable for disposal to drain without any precipitation processes. Usually the Gold deposit on the RenoCell cathode cartridge is suitable for direct reclaim by Precious Metal specialists without the need for transfer of a hazardous liquid, containing the Precious Metal, between sites.



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