# Circuit Technology

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## Marketing Direct Metallized PWBs

Since the initial introduction of two-sided printed wiring boards, the metallization of plated through-holes (PTHs) has been realized via catalysis with palladium and subsequent deposition of electroless copper. This is followed by electroplating as soon as the PTHs have an adequate thickness to provide the coverage and conductivity critical for efficient electrodeposition.

Electroless copper has a much slower deposition rate when compared to electroplating. A comparison for depositing 0.025mm/0.001 in. is as follows:

| Process | Deposition Rate |
|---|---|
| **Electroplated Cu** | |
| 2.16 A/dm (20 A/ft$^2$) | 54 min |
| 5.40 A/dm (50 A/ft$^2$) | 21 min |
| **Electroless Cu** | |
| 0.0025/mm/hr (0.0001 in./hr) | 10 hr |

Throughout the 1970s, interest mounted for an additive approach to deposit copper on PWBs. Electroless plating was used where required (*i.e.*, traces, pads, vias, PTHs). Advantages include:

- Elimination of etching (straight sidewalls)—ideal for fine line conductors <1.0mm–0.004 in.
- Uniform copper thickness throughout
- High throwing power—ideal for high-aspect ratio holes
- Permanent plating resist (copper conductors and resist are the same height from base laminate)—ideal for precise placement of components

Disadvantages include:

- Time consumption
- Waste treatment cost
- Hourly analysis and chemical replenishment to maintain uniform plating and bath stability

Several PWB fabricators invested heavily in this technique, but were unable to produce boards that were cost-competitive with subtracted technology. Currently, additive circuits are relegated to specific applications where the added benefits overshadow cost considerations (such as PWBs with high-aspect ratio vias or ultra-fine lines and molded circuit boards).

### Direct Metallization

Direct metallization (DM) is an operation whereby the nonconductive surface of PTH/vias is rendered conductive so that electroplating can be directly applied. Only in the past three years has there been a significant increase in the number of fabricators employing this practice.

The electroless copper metallization approach is time-consuming, requires precise monitoring, exact replenishment of all chemicals, and imposes extensive waste treatment.

There are numerous benefits for the fabricator committed to acquiring the obligatory experience required for a practical direct metallization process, not the least of which is streamlined manufacturing. Reluctance to experiment may result from selection of the most cost-effective method befitting the particular operation.

In addition, there is the fear that consumers (OEMs and contract manufacturers) may specify a particular process among those currently available. Fabricators and suppliers alike "compounded the felony," indeed, by failing to educate purchasers of the potential of direct metallized PWB. The fabricator is the one most aware that the streamlined operation via DM and acceptance of alternatives to HASL will produce a significantly viable PWB fabrication system.

### Customer Approval

Assemblers were eager to try alternatives to HASL (OSPs, Ni/Au, Ni/Pd, Ag and uniform solder coatings) because an urgent need existed for specific advantages of other surface finishes. Fine-pitch components demand flat pads and minimum warpage for efficient placement properties (unattainable with HASL). In addition, certain components are more proficiently attached by other techniques than with solder paste or wave-soldering (TAB, eutectic, thermocompression, ultrasonic, thermosonic bonding). This is not the case with direct metallized PWBs.

Because the OEMs and contract manufacturers have the power to specify the procedures used in manufacturing PWBs, they must necessarily be convinced that a streamlined fabrication process is in their best interest to assure a cost-competitive, reliable product.

There is a reluctance to abandon one time-proven process (*i.e.*, electroless copper metallization) for another that has taken so long to perfect. Introduced more than 15 years ago, it has only recently been a realistic alternative for high-volume production.

In order to continue an increase in the use of the direct metallized process (three percent to more than 18 percent over three years), the customer must be educated regarding this innovation in PWB manufacturing. Convincing OEMs and contract manufacturers of potential advantages will be the determining factor to prioritize DM as the preferred metallization process. ***P&SF***