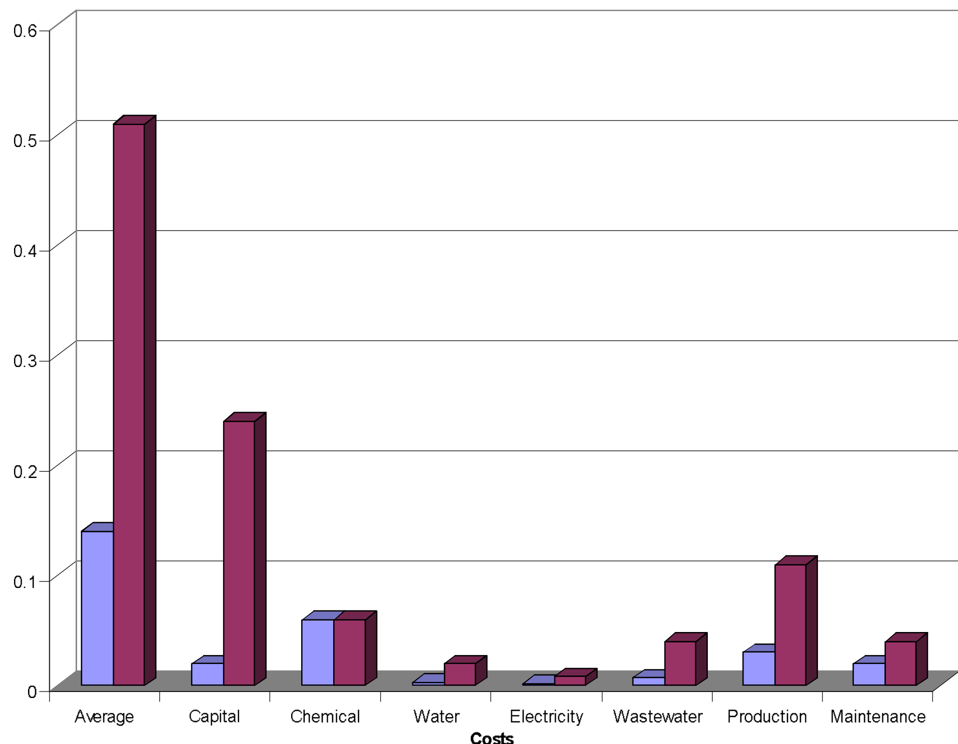
CharterDIRECT

Cost : DIRECT vs. Electroless



-DIRECT
-Electroless

Average	Capital	Chemical	Water	Electricity	Wastewater	Production	Maintenance
0.14	0.02	0.06	0.003	0.002	0.007	0.03	0.02
0.51	0.24	0.06	0.02	0.008	0.04	0.11	0.04
73	92	0	85	75	83	73	50

Source: EPA 744-R-97-002a - Printed Wiring Board Cleaner Technologies Substitute Assessment: Making Holes Conductive: Vol. 1

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Comparison of Direct plate process

Conventional Plating

- Cleaner (option)
- Chromic Sulfuric Acid
- Cr6+ -Reduction
- Pre Dip
- Pd Sn - Activator
- Removal of Tin
- Electroless Nickel
- Nickel Strike
- Electrolytic Metallization

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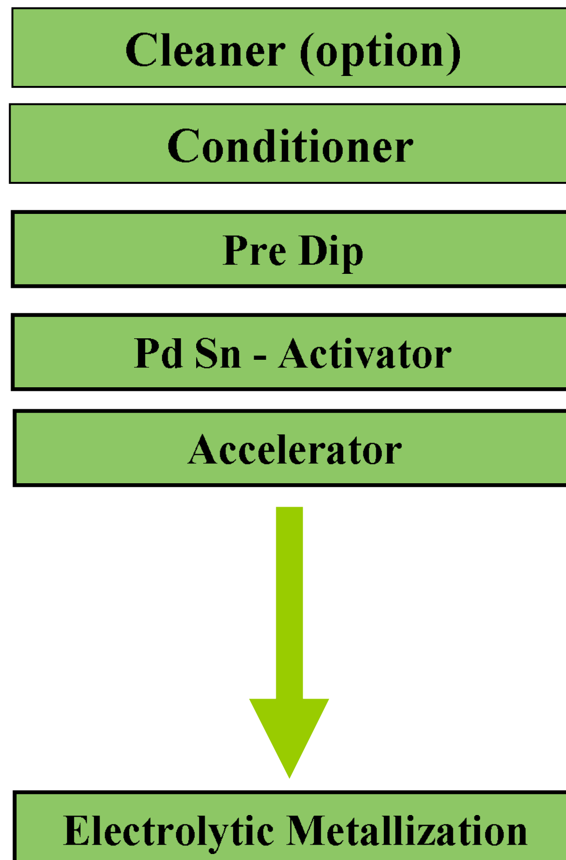

No use of Hazardous chemical (Chromic Sulfuric Acid & Electroless Copper) in the CharterDIRECT process

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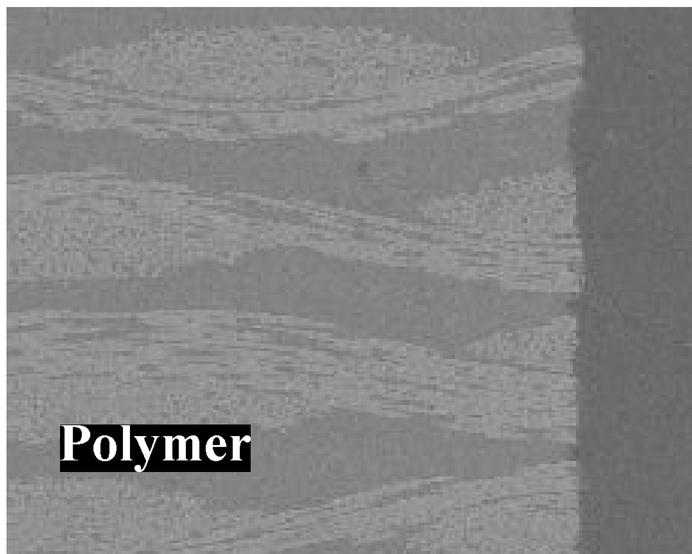
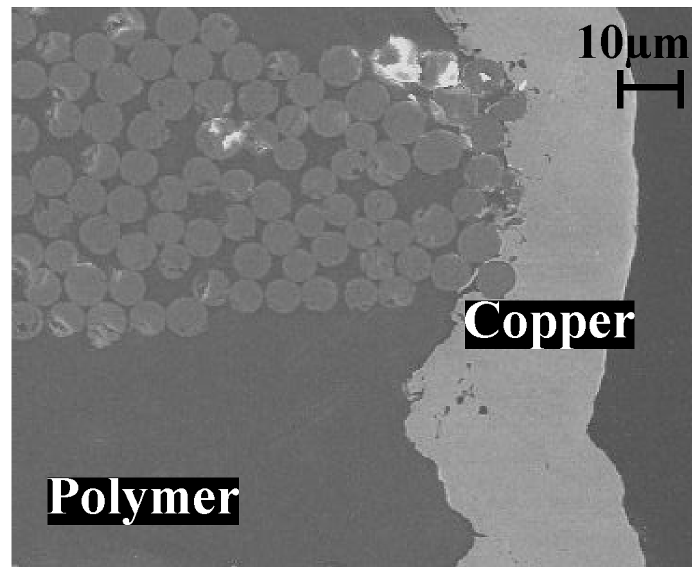
CharterDIRECT Process

SEM images of cross section of Polymer sample after treat with CharterDIRECT

Before



After



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History of Direct Metallization processes

Alternative New Throughhole Metalization Processes

Several families of replacement technologies have emerged over the last few years and are gaining momentum (see review article References [3-18]. Based on the chemical principle, these processes can be grouped as follows:

1. Palladium Based Systems
2. Carbon/ Graphite Based Systems
3. Conductive Polymers
4. Non-Formaldehyde Based Electroless Processes

1. Palladium Based Systems

In 1963, Radovski, an IBM researcher, patented a "direct plate" process. Radovski had found that under certain conditions one could take a board which had gone through all the preparations preceding the electroless copper bath, then go "directly" into an acid copper electroplating bath, and achieve electrodeposition of copper on the dielectric throughhole wall surface of drilled boards. This discovery did not immediately lead to a commercial application. In the mid 1980's the first commercial application

arrived in the form of vertical panel plating [19;20]. A special, single component organic additive copper electroplating bath had to be used. Since it yielded a copper deposit of inferior metallurgical properties, only a thin copper strike was applied, followed by a standard acid copper bath to build up to the full desired 25 micrometers (1 mil) metal thickness in the via hole.

In such a process, copper growth into the hole starts at the surface copper at the rim of the throughhole on both sides and slowly proceeds to the center of the hole where the two plating fronts merge. This process inevitably leads to some "dogboning" of the deposit, an undesirable thickening of the copper near the hole entrances and a thinner deposit in the center. Consequently, improvements of this process have focused on enhancing th plating speed through better throughhole coverage of the palladium and/or improving the conductivity of the deposit as well as making the process work in standard acid copper baths[21-23].

Source: Dupont Electronic Materials TB-9521 (Supersedes TB-9410)

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History of Direct Metallization processes

1.1 Systems Based on Palladium and a Second Metal [24]

To improve the conductivity of the palladium colloid, some systems have modified the acceleration step, i.e. the step in which tin is removed from the palladium, in such a way that in a chemical exchange reaction another metal, typically copper, is deposited on the palladium, taking the place of tin. These deposits show improved conductivity, speed up the throughhole metalization, and minimize dogboning.

1.2 Polymer Stabilized Palladium Colloids [25]

One commercial system uses an organic polymer to stabilize the palladium colloid. This polymer has chemical affinity to the conditioner chemistry covering the hole wall, thus assuring good adsorption of the palladium particles, resulting in more complete wall coverage and faster plating. There is a polymer removal step prior to electroplating.

1.3 Palladium Sulfide Coatings [26-28]

This process relies on the conversion of the discrete palladium particles to a continuous palladium sulfide film for better holewall coverage, better conductivity, and plating speed. Palladium sulfide is removed from the copper surfaces prior to dry film resist lamination and plating to assure good copper/copper bond integrity.

1.4 Very Small Palladium Colloids [29;30]

Several systems claim the use of superfine palladium colloids for better holewall coverage and improved conductivity. Plarticle size distribution measurements are difficult, and shelf life of the colloid and bath life may be a concern.

Source: Dupont Electronic Materials TB-9521 (Supersedes TB-9410)