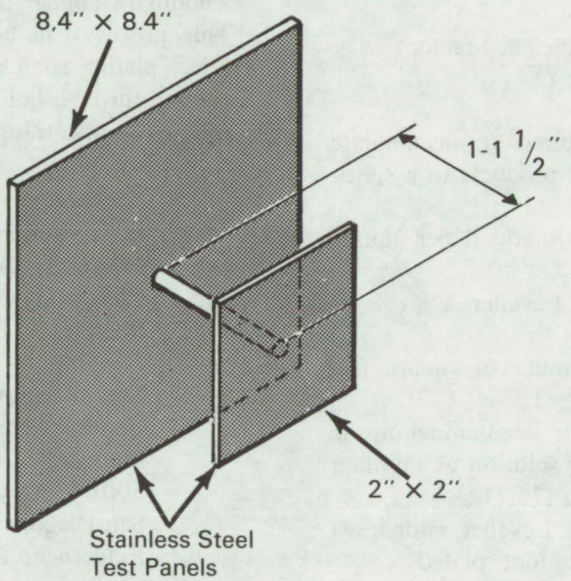
October 1967 Brief 67-10358

NASA TECH BRIEF

Steel Test Panel Helps Control Additives in Pyrophosphate Copper Plating



The problem:

To obtain optimum quality plating, it is necessary to limit the solution purification additives to quantities only sufficient to replace plating consumption losses. The organic leveller Additive-A breaks down to produce harmful solution contaminates. These lead to rough (nodular) and brittle (low ductility) copper plating. The contaminates are not detectable by conventional means. Plating solution has a maximum threshold tolerance level for these contaminates of approximately 200 ppm. A method was needed to keep below this tolerance level.

The solution:

A special test panel to provide low-, medium-, and high-current density areas such as would exist in production plating. The panel is plated in a production tank and plating is examined for uniformity of texture and ductility. Plating quality indicates need for additions of Additive-A or solution purification treatment.

How it's done:

The test panel is made by mounting a 2- by 2-inch tab on a rod so that the tab is approximately 1–1½ inches above one surface of an 8.4- by 8.4-inch panel. Both the main panel and the tab should be stainless steel polished on both faces. Approximately one square foot of platable surface results.

Plating tests have shown that maximum benefits from organic levellers such as Additive-A can be obtained by limiting solution additives to quantities that only replace plating consumption losses. The replacement needs can be accurately estimated with use of the special plating test panel. This determination can

(continued overleaf)

be made by noting the minimum addition of leveller-Additive-A required to plate a uniform satin finish over the entire test panel area. This quantity (e.g., 20 ml per sq ft of plated area) multiplied by the average square feet of area to be plated during a day becomes the minimum daily addition to the plating tank. The plating panel test will normally be used at the time of charging a tank with new solution and at periodic intervals during the lifetime of that particular solution charge.

Notes:

1. Application of periodic carbon treatments will remove harmful Leveller-A breakdown products and maintain solution contamination below process tolerance level. The following formula may be used to estimate the minimum necessary solution purification frequency.

$$F = \frac{D \times .80 \text{ (treatment efficiency factor)}}{A \times B \times C}$$

where:

F=Number of days required to accumulate Leveller-A breakdown products to a specified level

A=Milliliters of Leveller-A added per square foot plated

B=Active ingredients in Leveller-A (1% of total add)

C=Production Base—Number of square feet plated per day (average)

D=Maximum permissible contamination in 100 gallons of plating solution as milliliter equivalent in 200 ppm (75.7)

Example: Given: A=20 ml Leveller added per square foot plated

B=.01 (1%)

C=20 square feet plated per day (average)

D=75.7

$$F = \frac{75.7 \times .80}{20 \times .01 \times 20} = 15 \text{ days}$$

In this example it would be recommended that the plating solution be carbon treated once every 15 days.

2. The following solution makeup and operating conditions yielded successful results.

Copper metal:	2.5–4.0 oz/gal
Pyrophosphate:	17.5–28.0 oz/gal
Ammonia:	0.2–0.4 oz/gal
Pyro:Copper:	7.0–7.5 ratio
pH:	8.0–8.5

Addition agent Additive-A (Leveller): Approximately 20 ml/100 gal/sq ft of area to be plated

Operating conditions: Rapid air agitation; solution temperature 140°F; current density 25–35 a.s.f.

3. Verification of carbon treat efficiency in removal of contaminants may be made by checking test coupon plating for ductility and freedom of rough (nodular) copper plating.
4. This process can be used for high quality, low reject plating such as printed circuit boards (including through-hole plating).
5. Inquiries concerning this innovation may be directed to:

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or to

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Patent status:

No patent action is contemplated by NASA.

Source: W. T. Hollar
of General Dynamics/Convair Division
under contract to
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(LEW-10101)