Printed circuit boards-Immersion silver

Immersion tin has been generally favoured in Europe and North America, as against immersion silver (also referred to as 'IAg'), which was mainly used in Asia. However, immersion silver is gaining popularity, partly because it does not need hazardous or toxic chemicals.

Unlike nickel, the silver layer (0.07−0.25µm thick) totally dissolves in the solder joint, leaving a homogenous tin-lead-silver alloy joint directly onto the copper surface. The procedure is similar to immersion tin: compared with ENIG, both processes are easier to control, have short process times (high throughput), and operate at moderate temperatures. [The coating thickness depends on immersion time and coating bath temperature, but the required thickness of silver can be deposited in around 3 minutes at a bath temperature of 50°C].

The competing systems which you may encounter are 'Sterling' immersion silver from MacDermid and the AlphaLEVEL process from Enthone. With some small differences between vendors, the process can be carried out in either vertical (batch) or horizontal (continuous) equipment and consists of a dual pre-clean, a pre-dip and a silver bath:

Pre-cleaning, to remove light organic residues and allow for uniform conditioning.

Microetching the copper to produce a highly active polished copper surface.

A pre-dip to prepare the surface for coating, and reduce the formation of oxide.

The critical stage of coating deposits silver together with a percentage of organic material which protects it from the environment.

This last stage has the key process feature, which is the simultaneous deposition of an organic inhibitor. This both prevents the silver from migrating, and protects the silver from corrosion. Lucent reported1 that their experience in volume with immersion silver as a surface finish had been excellent and it had become the preferred finish at some of their manufacturing locations. The finish retained excellent solderability for over a year (if stored properly), handled multiple thermal excursions well and had superior hole fill characteristics compared to OSPs. Cost was intermediate between OSP and HASL finishes.

1 Robert Furrow posting to IPC TechNet 6 November 2000

They reported two relatively minor assembly issues:

The surface will darken if exposed to sulphur. The solderability remains good, but cosmetically it was very noticeable. This became evident at one location when, after

the first side surface mount operation, boards were placed onto an ESD mat that had a high sulphur content. Switching to a new type of mat resolved this issue

Pin contact at ICT, for those test pins that contact silver coated pads. As with OSP coated boards, probe types may have to be changed or the fixture optimised, compared with equipment used on HASL.

There are some practical issues about which the designer should be informed:

The contrast in colour between bare copper and immersion silver makes the coating easier to inspect for defects than OSP

Discoloured silver is a useful indicator that the boards have been mishandled after plating

The insertion forces of press-fit connectors on silver boards are greater than with tin-lead. However, if used with the appropriate pin coating, press-fit connectors have been claimed to be viable with immersion silver

Immersion silver gives good results with aluminium wire bonding for Chip On Board applications.

Though immersion silver appears attractive, there is a major obstacle with a number of industry sectors because of the attitude of Underwriters Laboratory, a key US approvals organisation. Because silver which has been plated without the co-deposited organic compound is very prone to migration, there are different tests for silver products than for other surface finishes, and these translate into spacing restrictions that make the designer's life very difficult.

This whole issue is currently up for debate, and some more rational approach is likely, reflecting the thinness of the silver layer involved and the fact that this is totally dissolved in the solder.

Author: Martin Tarr

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