Printed circuit boards-Immersion tin

Tin can be plated to give a very wide range of results depending on the conditions: matt tin is a very pure material: deposited from an alkaline solution without brighteners, oxide films on the surface can easily be penetrated by probes. Bright acid tin, deposited from baths containing small quantities of organic materials, has greater hardness and wear resistance, and is cosmetically more attractive.

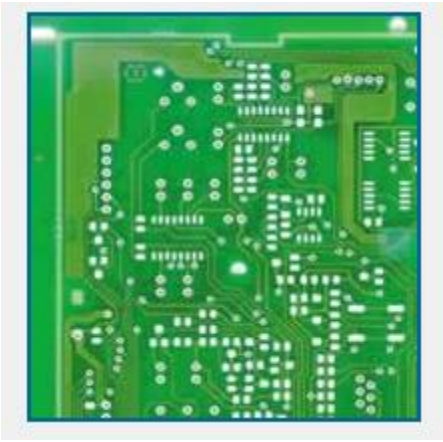

Figure 1: A PCB finished with immersion tin

Selective plating: OSP for SMD pads; ENIG for test points and ground frames

However, it has a much higher inherent stress, so is very subject to tin whiskers (see below).

A great deal of work has gone into producing tin finishes that will be a cost effective replacement for HASL. You will find mention of both grey tin and white tin in the literature. Both are flat uniform finishes, but the difference is more than colour: grey tin has large orthorhombic crystals; white tin has finer hexagonal crystals, giving a denser structure which is claimed to be more resistant to surface oxidation. The most commonly-found trade names for a tin finish are 'Omikron white tin' (Florida Cirtech Inc.) and 'Stannatech' (Atotech).

Typical process steps for immersion tin are:

An acid cleaner to remove oxides, organics and developer residues.

A microetch to provide a slightly roughened clean surface.

A conditioner, that creates a uniformly active copper surface on which the reaction can take place.

An immersion process carefully controlled to give a fine dense deposit of pure tin. [The thickness1 of deposit varies: Omikron 0.6–0.7μm; Stannatech 0.85–1.0μm].

1 Johal 2000 states that for a 4 hour exposure at 155°C (corresponding to 1 year of storage life), and with a thickness of <0.8µm of pure tin, the wetting angle drastically decreases compared with the fresh surface, indicating decreased solderability. However, the conditioning step greatly reduces the rate of deterioration.

Immersion tin deposition is not a normal displacement process, although it is self-limiting and depends on copper from the foil being exchanged with tin, but can only take place in the presence of thiourea. Unfortunately, thiourea is a suspected carcinogen, with health and safety implications, so the process needs to be tightly controlled. [Another process issue is that the dissolved copper has to be removed from the bath.]

A designer may well choose to use immersion tin in preference to HASL and other alternatives for applications which involve press-fit connectors, as the coating exhibits a useful degree of inherent lubrication, aiding the insertion process.

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Source: http://www.ami.ac.uk/courses/topics/0145_imsn/index.html