

Tech Talk

Fine Lines in High Yield (Part CXXXVI)

Touch-up and Repairs

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The subject of touch-ups and repairs is probably not well suited to feature under the tag line of Tech Talk, “*Fine Lines in High Yield*” because touch-ups and repairs are either incompatible or impossible with very fine line circuits. Nevertheless, it might be an interesting subject since PWB fabricators’ product mix is not necessarily all fine line work.

The industry has practiced “touch-up” on phototools and resist patterns on copper surfaces since the very beginning.

Touch-up of Phototools

A flawed phototool that is missing opaque features may be rendered useful by touch-up. The touch-up operator should perform his or her work in well-lighted environment, i.e. well balanced top and bottom (light table) lighting. Missing large opaque areas are touched-up by using brushes or fiber tipped pens. For small area touch-up so called “technical pens” are preferred. The pens should first be checked for their ink opacity in the UV region. The color of the ink is not a good indicator to judge if the ink is opaque in the UV region. The color of touch-up pens is typically red or black. Fiber-tipped pens are e.g. available from Letraset USA, Inc. (www.letraset.com) or from J.S. Staedtler, Inc. (www.staedtler.com).

Check the absorption of the ink into the anti-abrasion and emulsion layers of the phototool. Absorption of the touch-up ink into the top layer is desirable to avoid abrasion and flake-off of the ink from the phototool surface. The absorption characteristics of the ink into diazo and silver phototool top layers may be quite different. Recent improvements in the resistance of phototools to solvent attack may actually be a detriment to good absorption of the ink.

Tapes are occasionally used to touch-up phototools. This practice can be problematic. Tape adhesive can bleed out from the edges of the tape where it will then attract dirt. The tape thickness will cause off-contact printing in the vicinity of the tape which will cause blurred fine line features.


Scraping off unwanted opaque spots from a phototool is not a good practice: the scratched surface leads to radiation scatter.

Touch-up of Resist Patterns

Touch-up of resist patterns has become a less common practice since the institutionalization of “first article” check in order to catch defective phototools and avoid repeat defects. We looked at several “opaquing” pens, e.g. Action Marker pens from Mark-Tex Corp. (Ref. 1) and Kimoto Pake pens (check local graphic arts supply stores for Kimoto Pake pens; you may “google” Kimoto Pake and find several suppliers). Basically, the pen ink needs to behave like the photoresist itself: it needs to survive the developer chemistry (like exposed photoresist), survive microetchants, survive acid etch or alkaline etch respectively, survive plating and pre-plate cleaning, and last not



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least it has to strip. The Kimoto Pake super density retouching pen (red) is one of such pens that met these criteria in our tests. Of course, it is debatable if survival in plating chemistries is a requirement because the touchup of a pattern plating resist with an ink is not recommended since a certain resist height is needed.

Repair of Circuits

Circuit repair stations are commonly found next to AOI inspection stations. Once the AOI detects and marks extraneous copper, copper spurs, or shorts, it is possible to repair certain boards by removing the unwanted copper. This is typically done by flicking off the excess copper with a “picking knife” or an X-Acto® Knife, available at local art supply stores. Such manual repairs are limited to fairly coarse circuit patterns. More recently, LPKF has introduced the so called LaserScalpel repair tool that allows the repair of short circuits on finer lines and spaces (Ref. 2). The operator moves the scalpel into position with a joystick. Shorts on 50 micron lines and spaces have been repaired successfully. Conversely, open circuit defects can be repaired by welding. Such welding stations are positioned near the AOI inspection station, and one repair station will typically serve several AOI units. There are rules about how many open defects per board are allowed to be repaired, or if such repairs are permissible at all. The customer buying the boards will set these rules. In addition, there are IPC guideline documents such as Acceptability of Printed Boards (IPC-A-600), Acceptability of Electronic Assemblies (IPC-A-610), Rework of Electronic Assemblies (IPC 7711), and Modification, Rework and Repair of Printed Boards and Electronic Assemblies (IPC 7721).

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Reference

1. Mark-Tex Corp., 160 W Forest Ave., Englewood NJ 07631, United States
tel. (201) 567-4111, fax (201)567-7857
2. LPKF Laser & Electronics, 28220 S.W. Boberg Rd., Wilsonville, OR 97070, USA
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