Dissecting Film Defects

Controlling the facility, the process, and the personnel are the keys.

William J. Soules

A clean photoplotter and contact-printer environment is critical to overall imaging cleanliness, but the cost restrictions associated with a full-scale cleanroom often cause board fabricators to postpone upgrades in this area.

The prevalence of 6- to 10-mil lines and spaces and the acceptance of the practice of phototool touch-up have rendered the cleanliness levels of the past satisfactory. Despite the added cost, extensive cleaning of phototools and printers before each exposure has become standard operating procedure.

But the current trend toward decreasing line and space widths, increasing density, and the preference for first-generation phototools that need only minimal inspection and zero touch-up have altered the requirements. As a result, manufacturers of phototool films and chemicals have begun to provide product and packaging compatible with cleanroom environments. But these improvements are of little value if the film is contaminated by the plotter room environment or procedures.

The Elements of Cleanliness

There are three primary areas of concern for fabricators attempting to improve the cleanliness of their imaging process: the facility, the process itself, and the personnel. If one of these three elements slips out of control, it's highly likely that a contaminated phototool or board will result.

Facility

This refers to the environment in which imaging takes place. The cleanliness of the plotter and printer rooms is determined by the ventilation system; the materials that form the walls, floor, and ceiling; the process materials used in the room; the activities that occur in the room; and housekeeping practices. The ventilation system includes the air filtration, HVAC coils, airflow patterns, and number of air changes per hour.

The first step is to address product flow and unidirectional airflow considerations as they pertain to the printing room. These include not only the plotter, but also the laminator, board cleaner, and carts loaded with boards waiting to be exposed. In some cases, achieving unidirectional airflow may be as simple as placing a self-powered fan/filter unit over the operation. Equipment manufacturers should also consider product upgrades with this objective in mind.

The second step that may be required to improve cleanliness is the installation of a cleanroom with a specific classification (e.g., Class 10,000). This will enhance the environment but can be very expensive and, depending on its design and the way it's used, may not even yield cleaner images! In an improperly constructed cleanroom, air filtration efficiency is low, air is supplied and returned at the ceiling, air change rate is low, and construction materials generate particles. A portable cleanroom placed over a specific operational area can be a more economical use of unidirectional (laminar) airflow. A thorough study of the process should be conducted before the decision is made to construct any type of cleanroom. We'll go into more detail on the subject of processes a little later.

In laying out a plotter room to accommodate a portable cleanroom, the path of the film's movement throughout the room should be kept as short as possible. The smaller the cleanroom, the better.

Process

The process involves all the equipment, materials, and procedures used to generate the image. In the area of equipment, photoplotter design and cleanliness are
**Imaging**

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**Conclusion**

When the facility, the process, and the personnel are in control, the imaging problems resulting from airborne contamination are greatly reduced. The good news is that an expensive cleanroom configuration is not essential to achieving high-yield imaging of today's complex designs.

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