

Tech Talk

Fine Lines in High Yield (Part CXXVII)

Lamination and Coating Equipment

Karl H. Dietz (for CircuiTree Magazine, April, 2006)

At the last TPCA Show I noticed a remarkable variety of new coating and lamination equipment and upgrades of established equipment lines which prompted me to do a short review of this subject. It has been quite some time since Tech Talk looked at critical hot roll lamination parameters in a two part series (see Ref. 1 and 2). In the late 1990s we then looked into opportunities for



Fig. 1: New Bell Type Automatic Electrostatic Spray Coating & Drying Line (source: GROUP)



Fig. 2: Cover Layer Hot Press Line (source: GROUP)

improved laminator designs, notably laminators that featured “crowned” rolls for more uniform pressure across the lamination nip and lamination equipment capable of applying much higher pressure than conventional equipment (see Ref. 3-5). Such designs are now commercially available. My colleague Ed Hagan and I also tried to systematically catalogue types of lamination wrinkles, probe their root causes, and propose corrective actions (see Ref. 6). More recently, I took a fresh look at vacuum lamination since there appeared renewed interest in the technology based on new applications and needs (Ref. 7).

The coating and lamination equipment displayed at the TPCA Show I attended is used to apply liquid photoresist, dry film photoresist, soldermasks, and flex coverlays. Most improvements aim at better conformation of dry film (or coverlays) to non-planar, or contoured substrates, or at better liquid coating thickness uniformity and compatibility with thin sheets or reel-to-reel flex. Song Tex builds a soldermask coater in Taiwan that is based on a Japanese (PMF) design. The panel rests on a tilted surface and enters the coating chamber first with a corner point (not a leading edge) and exits it with a corner point last (not a trailing edge). This curious design results in better coating thickness uniformity. GROUP introduced a new spray coating line for soldermask application (Fig. 1) and also displayed its established vertical roller coater. Asia Neo Tech Industrial Co., Ltd. also showed a new soldermask spray coater as well as its older roller coater and drying equipment. It is not clear to me what is driving the new introductions of spray equipment after such designs have found little acceptance in the industry in the last 20 odd years. GROUP showed new equipment for the application of flex coverlays (“hot press automatic line”, see Fig. 2). Hakuto introduced a new vacuum laminator

Karl Dietz is the manager at DuPont's Electronic Materials Laboratory, Research Triangle Park, NC. His responsibilities include application studies for printed circuit materials. Karl has 35 years of experience in a variety of R&D, manufacturing and quality control functions and holds a PhD. in organic chemistry from the University of Frankfurt, Germany. If you would like to participate in the exchange or if you have any questions, Karl Dietz can be reached at 919-248-5248, fax: (919) 248-5132, or via e-mail <Karl.h.dietz@usa.dupont.com>.



Fig. 3: Dry Film Lamination Line
(source: C Sun)



Fig. 4: Dip coater for flex circuits (FPC) FD-0411 (Source: SDI Company Ltd)

(Mach V520). It features a preliminary lamination stage, a lamination stage (vacuum/pressure), cooling, and a final “flattening stage” with vacuum and pressure.

The Meiki vacuum lamination system MVLP 500/600-IIA, a two-stage laminator is still the industry standard for applying micro-via build-up dielectric films in flip chip substrate manufacture. C-Sun’s new vacuum laminator could make inroads in this application. The one-chamber vacuum laminator VL-SA 24 comes with a pre-lamination film tack-down unit (CSL-A25V). This equipment targets dry film applications over contoured surfaces which can present

conformation problems for conventional hot roll laminators. Such applications include rigid-flex, flex coverlays, and dry film lamination for mixed surface finishes (e.g. ENIG/OSP). C-Sun also showed its hot roll laminator that includes a “post-lamination roll lamination unit”. It was reported that C-Sun has developed a new high pressure hot roll laminator and a double-roll laminator that is reminiscent of an Asahi hot roll laminator design. This new equipment was not yet on display. C-Sun’s traditional automatic CSL line includes a pre-heat station for better resist conformation and a post-lamination cooling station which is typically used to improve the reliability of the tent-and-etch process with thinner dry film photoresists (see Fig. 3). C-Sun was also represented with its well-known roller coater equipment. In one of the New Product Introduction Exhibitor Seminars I learned about a Japanese liquid photoresist roll-to-roll dip coater for thin flex material (F0-0411), represented by Sunway Scientific Corporation and featuring Goo Chemical Co., Ltd. (Japan) negative-working liquid photoresist. Positive-working photoresist is under development.

Recently, I have been more involved in semiconductor packaging materials and processing, and I noticed that this industry also uses very specialized lamination equipment. Nitto Denko (Japan), for example, supplies systems for holding and transporting wafers. A laminator (DR-8500II) is used to apply tapes to the wafer. The function of such tapes is to hold the fragile wafer firmly and safely in place during back-grinding and dicing operations. Microcontrol Electronic (Milan, Italy) offers the 812 Series “taper & de-taper” for wafer level packaging. Unlike the cut sheet laminators used for dry film in PWB fabrication, this special cut-sheet laminator does not perform a straight cut but a circular cut of the dry film applied to the wafer surface e.g. for the purpose of wafer bumping.

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