EB Technology—A Converter's Winning Solution

By Rick Sanders

It's no secret that today's flexible packaging converters face a growing challenge from overseas competition. It is universally accepted that labor rates in other countries are significantly lower than North America, so converters need to do something to stay competitive against these new challenges.

One way to stay a head of the competition is to offer better or equal products at lower costs. Streamlining the operation and reducing operating costs can accomplish this. Enter, electron beam (EB) technology to shorten the production process and reduce costs.

One way to stay a head of the competition is to offer better or equal products at lower costs. Streamlining the operation and reducing operating costs can accomplish this. Enter, electron beam (EB) technology to shorten the production process and reduce costs. Here are two examples to streamline the converting process.

Replace a Laminated Structure with a Single Ply Structure and an EB-Cured Overprint Coating

Currently, many converters in the flexible packaging industry reverse print a base film using solvent- or water-based flexographic presses. These base films are then laminated to a second layer of film using a laminating adhesive process. This multi-web, multi-step approach has provided certain desired properties like high gloss, graphic protection and stable coefficient of friction (COF). EB-cured overprint coatings can provide the same attributes while delivering improved quality, shorter delivery times, improved quality controls and reduced pricing.

Let's examine the steps required to make laminated structures for the flexible packaging marketplace. First, most converters reverse print on a clear film and then set the printed film aside to await the next step.

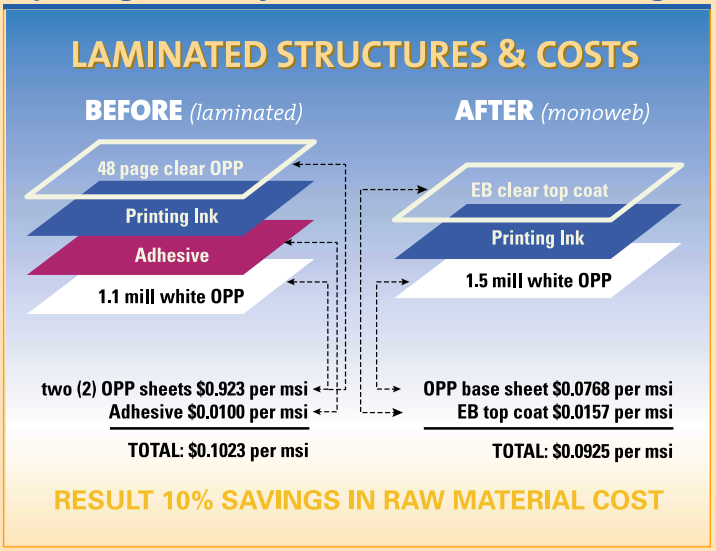
This printed roll of film is ready for the next step in the process. The printed roll is laminated, or glued, to another layer of film. Most converters today use a solventless adhesive formulation that usually requires several days to fully cure. The adhesive-curing process has to be complete before the laminated structure can be moved for further processing like slitting the web to a smaller size and making it into a package of some sort.

Occasionally some films will not laminate properly to each other. If this "bad" product is caught before shipment to the customer, it requires that the job be rerun. This results in delivery times even longer than normal.

There are many benefits of converting with EB technology. EB-cured inks and coatings provide high gloss with excellent graphics protection. Converters can surface print the film with either conventional inks or new EB wet-trap inks. Following the inks, an EB-cured overprint coating is applied and cured.

FIGURE 1

Comparable structures and potential savings by replacing a film layer with an EB-cured coating



Due to the instant cure nature of EB processing, converters can print the job and then ship it to their customer the same day. EB-cured coatings deliver the desired properties of high gloss, graphics protection from scratch, scuff and abrasion plus achieve a targeted COF, sometimes referred to as "slide angle."

Figure 1 helps to illustrate the comparable structures and the potential savings by replacing a layer of film with an EB-cured coating.

Now let's take a look at what 10% raw material savings means when applied to a production line. Figure 2 shows the savings realized when a press running a 54" wide substrate at 1,000 fpm for one year (4,000 production hours).

Figures 1 and 2 only show the "material" savings equation. Added to this is the time saved that is realized through the instant cure process of EB.

By utilizing EB technology, the need for the second layer of film is removed. Eliminating the second layer of film reduces the material cost of the package itself. Furthermore, by eliminating the second film layer, the time it takes to print, laminate, cure the adhesive and eventually ship the product to customers is significantly reduced. Production jobs that may take other converters a week or more to process are reduced to days or hours to ship. Thus, EB technology allows for a streamlined process that reduces material cost, processing cost and time.

FIGURE 2

Savings realized with EB coatings vs. laminations

	CURRENT STRUCTURE	PROPOSED STRUCTURE
	50GB BOPP/RP/Adh/1.1 mils BOPP	1.5 mil BOPP/Surface Print/EB OPV
	$ per 1,000 Square Inches (MSI)	$ per 1,000 Square Inches (MSI)
Cost of 50G & 1.1 mils OPP	$0.0923	--
Solvent Based Adhesive	$0.0100	--
Cost of 1.5 mil OPP	--	$0.0768
EB OPV @ $4.00 lb & 1.7 lbs/ream	--	$0.0157
TOTAL	$0.1023 per MSI	$0.0925 per MSI
TOTAL COST PER YEAR	$15,909,696	$14,385,600
NET SAVINGS	**10%**	**$1,524,096**

ASSUMPTIONS:

Product Width	54" Wide
Production hours	4,000 hours per year
Line speed	1,000 feet per minute
Total annual production	155.52 Million MSI

Instant-Cured EB Laminating Adhesives Replace Conventional Laminating Adhesive

As stated previously, most conventional laminating adhesives require many hours and even days to properly cure before the next step in the converting process can proceed. Additionally, laminations are processed in an additional step, requiring additional handling and using additional equipment, after the printing process.

During the curing process with conventional adhesive laminations, quality control (QC) checks are periodically made to ascertain that the adhesive is indeed adhering properly. These QC checks usually identify "bad" product, but not in all cases. Bad product can include poor adhesion of the films to each other or air bubbles trapped between the film layers. Unfortunately, some "bad" product can be missed and shipped to customers. This is an undesirable result for the converter and customer.

With EB instant-cured laminating adhesives, a converter can print and dry the ink, apply the adhesive, then apply the secondary layer of film, nip

the structure together and cure an EB-curable adhesive in one pass on one line. The implications are enormous! A laminated structure that literally took days to complete can be reduced to hours with this streamlined print, laminate, cure process.

By utilizing the instant cure EB adhesive, the converter not only significantly reduces steps in the process but increases the quality control. The instant-cure nature of EB processing, allows product quality control to be immediate and inline. As a result, consistent product quality is assured on every job. This helps to assure both the converter and customer of consistently good product.

Figure 3 illustrates how reducing processing time can result in significant cost reduction. As with Figure 2, the calculations are based on the assumption of a 54" wide lamination substrate that is printed and laminated in line at 1,000 fpm.

The calculations used to determine the savings are stated in Figure 4.

By using EB instant-cured laminating adhesives to streamline the lamination process, warehouse space that is used for "Work-in-Process" inventory can now be used for other more profitable purposes. Valuable "storage" space can be converted into additional production space. Thus, a greater amount of product can come out of a physical plant without having to commit financial resources to increase square footage.

Summary

By incorporating EB technology to streamline the converting process, converters can stay ahead of the competition that is encroaching on the marketplace.

—Rick Sanders is sales and marketing manager for Energy Sciences Inc., Wilmington, Mass.

FIGURE 3

EB vs. solvent-less laminating adhesive annual cost of operation

ITEM	EB LAM ADHESIVE	SOLVENT-LESS LAM ADHESIVE
Chemistry	$1,188,000	$792,000
Utilities (Electricity)	$25,000	--
EB Maintenance	$1,500	--
Cure Time Cost	--	$216,679
Trim Waste Cost	$80,870	$384,134
CC Material Waste	$20,218	$202,176
TOTAL	**$1,315,588**	**$1,594,989**

EB OPERATING SAVINGS 17.5%

FIGURE 4

EB vs. solvent-less laminating adhesive cure time, waste & work-in-progress calculations

A. CURE TIME COST

$16,679 (10% interest on 3 day W-I-P Inventory) + $75,000 (Warehouse Rent) + $75,000 (Labor & Overhead) + $50,000 (Heat, Utility & Insurance) = $216,679 Total Cure Time Cost

B. TRIM WASTE – MATERIAL COST

0.4% EB Trim Waste x $20,217,600 (annual material cost) = $80,870 Total EB Trim Waste

1.9% SL Trim Waste x $20,217,600 = $384,134 Total SL Trim Waste

* Solvent-less adhesive tends to ooze during curing. The product is NOT laminated to the edge to avoid blocking. After cure, edges are trimmed off & discarded. EB will produce significantly less waste.

C. QUALITY CONTROL WASTE – MATERIAL COST

0.1% EB minimal yield loss due to instant cure) x $20,217,600 (annual material cost) = $20,218 Total EB waste

1% (Solvent-less yield loss due to inadequate cure) x $20,217,600 = $202,176 Total SL waste

D. WORK-IN-PROCESS INVENTORY

3 Days (33 Production Hours) (Minimum time to cure solvent-less adhesive) x $5,054.40 (Hourly material production cost) = $166,795 (Work-in-process savings)

Assumptions:

Structure	48 Gauge PET/Print/Adhesive/2Mil LDPE	EB Lam Adhesive cost/pound	$3.00
Production Hours =	4,000 hours	Solvent-Less Adhesive cost/pound	$2.00
Line Speed =	1,000 ft/min	Films & Ink Coat =	$0.13/MSI
Web Width =	54 inch	Material Production =	$5,054.40/hr.
Adhesive Coating Weight =	1.1 lb/ream	Annual Material Production (MSI) =	155,520,000
Ream =	3,000 ft^2	Annual Material Cost =	$20,217,600