EDI Advances
News and Concepts from Your Global Partner in Extrusion, Coextrusion & Converting
ISSUE NO. 19

PS Foam Die Innovation Yields Big Increase in Extruder Uptime

A complete die system developed by EDI for extruded polystyrene (XPS) foam board dramatically reduces downtime for product changeovers, enabling manufacturers to offset much of the loss in productivity caused by switching to non-ozone depleting blowing agents. In addition, EDI's XPS foam board die technology incorporates innovations that enhance control over product dimensions, reduce scrap, and eliminate shutdowns for die maintenance.

The switch from HCFC to HFC blowing agent, mandated in the U.S. by the federal Environmental Protection Agency, must occur by January 1, 2010 in countries that are signatories to the Montreal Protocol. In conventional XPS production lines, the process changes needed to accommodate the new blowing agent (such as additional cooling) reduce board production by 30%. The new EDI system addresses this problem by removing an altogether different barrier to productivity—the hours of downtime incurred with conventional die systems whenever a change in product dimensions must be made.

"The EDI XPS foam board die technology makes it possible to accomplish a product changeover on the fly in only 15 minutes," says Dennis S. Paradise, vice president of sales and marketing. "By comparison, a change in width or thickness with a conventional die system requires shutting down the production line for at least eight hours, followed by a two-hour startup phase in which no saleable board is produced—only scrap. The added uptime generated by our new system is sufficient to offset the lion's share of the output loss imposed by the switch to HFCs."

XPS foam board producer **DiversiFoam Products** reports that by using the new EDI system at its Rockford, MN, plant, the company has virtually eliminated downtime for scheduled thickness setups, making it possible to produce 11% more saleable product. Operations manager Steve Slavik reports other benefits: "Our new die can operate at a much higher pressure than the old one, which is very important when using HFC blowing agents. In addition, it provides better temperature control, enhanced adjustability, and simpler maintenance."

Fast Product Changeovers and Greater Uptime

While EDI has successfully supplied dies to the XPS foam board industry for years, its new die system represents a totally different design developed for efficiently

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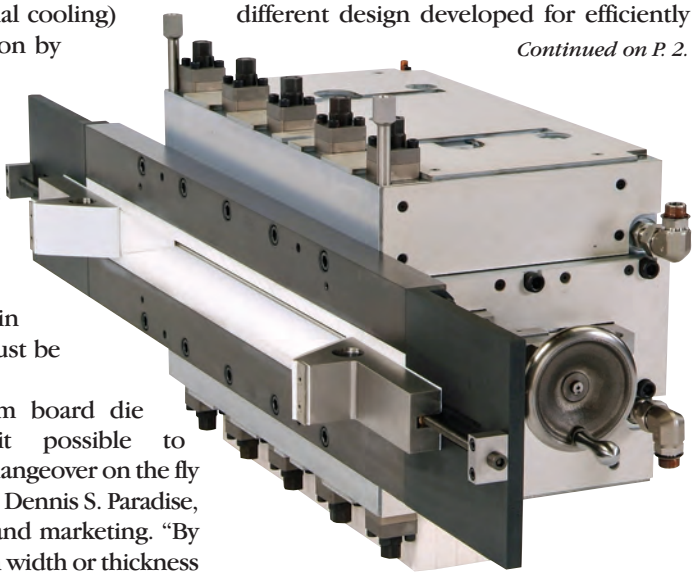


MORE UPTIME FOR XPS BOARD. Complete die system yields big reductions in downtime for job changeovers. New type of forming box (shown at front of die facing left) is separate from die lip and independently adjustable, unlike most conventional systems. As a result, product changes do not involve stopping the production line and disassembling the lip/forming box.

Improved Coating Makes Die Lips Sharper, More Wear-Resistant

While an increase in uptime was the ultimate benefit of EverSharp™ tungsten carbide-coated lip edges when EDI introduced them five years ago, this advantage is now even greater. Recent advances by EDI and coating supplier Praxair Surface Technologies have made tungsten carbide lip surfaces more durable and lip edges sharper. For companies that extrude film and sheet or apply coatings, this means fewer production stoppages to clean away lip buildup or sharpen lip edges.

Tungsten carbide coating lasts eight times longer than chrome plating. This durability makes it possible for EDI to grind lip edges to exceedingly small radii and for those edges to maintain their sharpness. In turn, sharper edges provide less opportunity *Continued on P. 7.*

SUPER-WEAR RESISTANT EDGES. EverSharp™ tungsten carbide coating is eight times more durable tham chrome plating.

Inside...

- **Turnkey Hot Melt System Increases Output and Accuracy**
- **Rheology: Key to Optimum New-Die Performance**

Continued from P. 1. processing material containing the new HFCs.

One of the central innovations is a ***new type of forming box.*** When polystyrene passes through any XPS foam board die, it is charged with blowing agent. As it exits the die lips, it undergoes a thirty-fold increase in volume almost instantaneously. This expansion takes place just beyond the lips in the forming box, which has four-way adjustability. The forming box gives the board its initial shape in terms of thickness and width.

DiversiFoam PRODUCTS

This XPS foam board manufacturer reports 11% more saleable product with use of EDI die system.

In most conventional die systems, the forming box and die lip constitute a single component. Changing the dimensions of the board requires stopping the production line, disassembling the lip/forming box, adjusting for new product dimensions, and reassembling the unit. The forming box in the new EDI system, on the other hand, is a separate, independently adjusted component that makes possible on-the-fly product changeovers without stopping the production line. The box is readily disengaged from the die by loosening bolts. Changes in dimensions are accomplished by sliding out special Teflon® inserts and side shoes and replacing them with ones having different geometries.

The new forming box design is not the only component that plays a key role in providing the big reductions in downtime achievable through on-the-fly adjustment. A second component is an ***adjustable full-manifold internal deckle*** inside the flow channel of the die. The deckle quills at either end of the manifold can be used to change flow-channel width by being moved farther into the channel or farther out.

Deckles are conventionally used for changing product width, but in the XPS process, where the material ultimately expands in all directions, deckles can be used to adjust thickness as well. By coordinating the settings of the deckle quills and the forming box, for example, it is possible to produce thicker board without changing width. This on-the-fly capability makes it possible to do so with little adjustment in comparison with conventional die systems.

Still another component for ensuring dimensional consistency is ***external edge restrictors*** that create the final side dimensions of the board as it emerges from the forming box and passes between the two top and bottom sizing plates that are typically used in foam board production. Mounted on rails that extend from the front of the forming box, the edge restrictors ensure board edges that are more flush and flat. Here too, the omni-directional nature of foam expansion comes into play. While edge trim losses in conventional XPS board production typically are around 10%, restricting expansion at the edges results in more lineal feet of board.

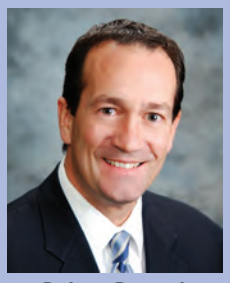
A fourth innovative component in the EDI XPS board die system is a ***purge block*** located between the extruder and the die. This makes it possible to carry out die maintenance while the extruder is temporarily shut down but still full of polymer. The purge block acts as a valve, blocking flow from the extruder while purging material from the die.

EASING TRANSITION TO NEW BLOWING AGENT. On XPS foam board production lines like this one, the switch from HCFC to HFC blowing agent will require additional cooling and other steps, reducing production by 30%. New EDI die technology will offset most of this output loss through increased uptime for product changeovers.

XPS Foam Die: No Longer a 'Black Box'

"A conventional XPS foam board die typically was a kind of 'black box' that provided limited opportunity for adjustment and required shutdown and disassembly for most product changes or maintenance," says Dennis Paradise. "We developed our new die system not just to address the change in blowing agents but to help customers make their production lines more efficient and versatile."

It is not just because of the January 1 deadline that this advance in die technology is timely, Paradise notes: "XPS foam board insulation plays an important role in weatherizing homes and buildings to reduce consumption of fossil fuels and combat climate change. As governments create incentives for corporate and homeowner investment in insulation, our system can help board producers meet the resulting demand with maximum profitability." ◆



Robert Deitrick

Robert Deitrick Is Named EDI Sales Director for the Americas

Robert Deitrick, a sales and marketing specialist with a background in web gauging systems, has joined EDI as director of sales for the Americas. He will supervise the company's regional sales managers in the U.S. and Canada and oversee the activities of EDI's network of agents throughout Latin America.

"Bob brings more than 15 years of experience in managing sales programs for the advanced instrumentation systems used in extrusion and converting," says Dennis S. Paradise, vice president of sales and marketing. "His extensive knowledge of every sales region in North, Central, and South America includes familiarity with many EDI customers."

After managing sales programs for Measurex Inc. (now part of Honeywell), Deitrick joined EGS Gauging (now part of Thermo Fisher Scientific), where his final position was that of vice president of sales for the Americas. For both companies he held sales responsibilities for Latin America as well as the U.S. and Canada.

Robert Deitrick attended De Anza College and San Jose State University, both in California, and is in the process of pursuing his MBA degree. He took part in the Advanced Electronics Program of the U.S. Navy, where he attained the rank of first class petty officer.

EDI Rheology Lab Is Key to On-Target Performance of Your New Die

At EDI, building a die without rheological data on the resin it will process is like tailoring a suit of clothes without first taking the customer's measurements. The chances of an accurate "fit" are not good. Since the very purpose of the die is to tune the flow of material passing through it, obtaining complete data on the flow characteristics of that material is essential.

In a new article by EDI vice president of technology Gary D. Oliver for the newsletter of the Society of Plastics Engineers (SPE) Extrusion Division, the word "complete" receives great emphasis. "Some customers wonder why we urge them to let us do rheological analyses of their resins since, after all, these materials came from their suppliers with data sheets that included melt flow indices," Oliver says. "But melt index describes flow under only one set of conditions, and in an extrusion die conditions change as the material flows from one region of the die to the next. Without a controlled sequence of changes in shear and elongational forces, the die wouldn't be able to do its job, which is to generate a product that is consistently on-spec."

Rheology, the science of viscosity, measures the changes in a material's resistance to flow as it is sheared, or worked. Some customers supply EDI with rheological data on their resins in the form of a table showing viscosity values over a range of shear rates. But for many customers, such data are difficult to obtain without paying for the services of an outside laboratory or spending $100,000 to $150,000 for a capillary rheometer, plus more for the wages of a technician to operate it. For this reason, EDI maintains an extensive rheological laboratory—a capability that sets it apart from other die manufacturers. All that a customer needs to supply is a 15 kg resin sample.

Recently, EDI transferred this lab to the new Technology Center in Chippewa Falls and expanded its resources. At the heart of the lab is an extruder that provides molten polymer to a capillary die at various flow rates, making it possible for EDI specialists to determine the viscosity of the material under different shear rates and to prepare a rheology curve over a wide range of shear rates. The resin or blend thus analyzed may include multiple polymers, regrind, additives, and colorants.

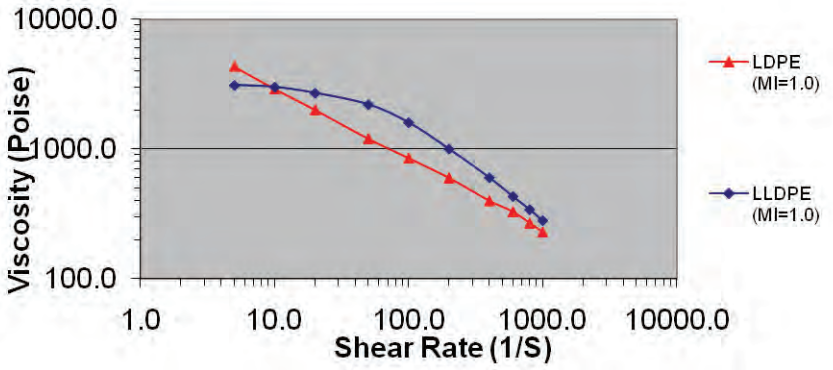
EXTENSIVE RHEOLOGY LAB, part of which is shown here, is a capability that sets EDI apart, enabling the company to design die manifolds for optimum tuning of polymer flow in accordance with the resins to be processed by the customer.

The ability to do in-house compounding as well as physical blends insures accuracy of composition. Viscosity measurement is supplemented by a highly instrumented stand-alone capillary rheometer with advanced software for curve fitting and data correction.

Why Melt Index Is Not Enough

In comparison with a rheology curve such as one developed in EDI's lab, a melt flow index is based on a test in which the shear rate is constant and very low in value—typically 1 to 10 reciprocal seconds, versus 10 to 1,000 encountered in extrusion. Two resins with the same melt flow index may perform very differently in the same die. If rheology curves were developed for each of the resins, the curves would intersect at a low shear rate—hence the identical melt flow indices—but at the higher rates common in extrusion would diverge considerably, indicating big differences in viscosity (see graph).

"Melt flow index is an excellent tool for ensuring the quality of incoming resin shipments but has little value for predicting how the resin will behave as it flows through the varying internal geometries and transitions of the flow channel or manifold of an extrusion die," says Oliver. "A complete rheology curve enables us to engineer a manifold designed for optimal flow, accurate dimensional control, and reliable, high-output production." ◆



ONE MELT INDEX, TWO RHEOLOGIES. Curves intersect at very low shear rate, where melt index test takes place, but diverge at higher rates typical in extrusion.

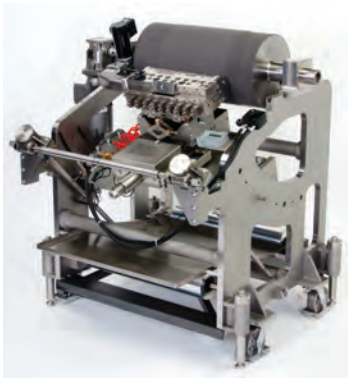
Global Report

EDI PROVIDES 'ENABLING TECHNOLOGIES' FOR BATTERIES. Just as lithium-ion batteries are key to developing next-generation hybrid and all-electric vehicles, EDI coating and film systems play an important role in making these batteries more compact, lightweight, and efficient. The working heart of each lithium-ion battery cell is a ***precision multilayer structure of slurry-coated electrode foils and the micro-porous films that separate them***. Today EDI supplies Ultracoat® and Liberty® slot die systems and Contour® cast film systems to manufacturers of battery components, working with them at their own facilities and in the laboratories at EDI's new Technology Center in Chippewa Falls. The company draws on seven years of work on coating process technology for batteries used in portable electronic devices, including military devices under four U.S. Department of Defense contracts. "EDI's experience relevant to lithium-ion batteries also includes other critical multilayer electronic applications like flat panel displays and solar panels," says EDI president John A. Ulcej. "We see ourselves as providers of enabling technologies for manufacturers seeking to increase battery efficiency, reduce weight and cost, and ensure reliability."

A NEW EDI CAPABILITY: REWORKING BLOWN FILM DIES. In the U.S. and Canada, EDI has applied to blown film dies its long-established expertise in reworking flat dies. After acquiring Quality Machine of Chippewa Falls, Inc. (QMI) one year ago, EDI continued that company's blown film die reconditioning business while drawing on its own resources to create an essentially new operation, according to global aftermarket manager Scott G. Smith. Today EDI maintains an 11,000 sq.ft. (1,020 sq.m) section of the former QMI facility as a ***dedicated blown film die rework plant***, one that can be operated around the clock on a project if a customer needs expedited service. The plant is located half a mile (0.8 km) from EDI's world headquarters. "EDI has reworked flat dies built by us and other companies for most of its 38 years, developing proprietary remanufacturing techniques and establishing rework as an important part of the company's business," says Smith. "While we do not build new blown film dies, reworking them is a natural next step for us." Smith notes that EDI also provides resurfacing of worn or damaged rubber rolls used in both film and coating processes.

NEW AGENT FOR EDI IN KOREA. A firm with expertise in sales and technical support of plastics processing and web converting equipment, Daejoo Industrial Company was established in 1983. In the converting field, the company is the agent for international suppliers of surface treating, scanning, coating, flexographic printing, and other systems. Extrusion processing ranges represented by Daejoo include blown and cast film, sheet, and coating, plus related thermoforming, medical bag making, and auxiliary equipment. The company is headed by Mr. S.J. Kang, CEO and is located at 201 HanWon Building, 6-1 Sunae-dong, Bundang-gu, Sungnam-si, Kyunggi-do 463-825 Korea. Tel: 82-31-719-4017. Fax: 82-31-718-4017. Email: sjkang@daejooi.com.

SLOT DIE SYSTEM AVAILABLE FOR ON-SITE TRIALS IN CHINA. EDI has shipped a Modular Coating System (MCS) to its subsidiary EDI Precision Dies (Shanghai) Co., Ltd. (EDI China) for on-site trail runs of slot die coating at factories in Asia. The MCS is ***a complete slot die coating station, with all components from idler roll to backing roll***, enabling companies to eliminate hours of setup in switching from roll to slot die coating as they carry out product and process development with slot dies in their own plants. It has already been employed by China-based manufacturers of lithium-ion batteries. "With a standard slot die coating system assembled from individual components, it can take up to half a day, and even more for really large dies, to set up the system so that it is vertically plumb, the rolls are level with respect to one another, and the die is properly positioned with respect to the backing roll," said Jason Q. Yin, general manager of EDI China. "EDI's MCS eliminates much of this time, along with the risk of damaging rolls during handling."



EDI NAMES PLASTTEKNIK AS NEW AGENT IN TURKEY. Plastteknik İthalat İhracat Ltd. Şti was formed by two partners experienced in serving extrusion processors and web converters. Besides EDI, Plastteknik already represents international builders of plastics auxiliary equipment. "Plastteknik's founding partners draw on more than ten years of experience providing sales and technical service to users of flat die systems in Turkey," said Dennis S. Paradise, EDI's vice president of sales and marketing. "Their company will support a large extrusion and converting industry in which EDI has long had a presence and which continues to be a vital, growing market for us." The company was formed by Kerem Anil, and Omer Kanbak. Both Mr. Anil and Mr. Kanbak are mechanical engineers. Plastteknik's website is currently under construction at www.plast-teknik.com. Plastteknik İthalat İhracat Ltd. Şti is located at Sasmaz Sitesi Degirmen Sok. Cemal Bey Is Hani No: 15/10, Kozyatagi-Kadikoy-Istanbul. Tel: 90-216-445-7918. Fax: 90-216-445-7872. Email: o.kanbak@plast-teknik.com.

JON ANDERSON TAKES CHARGE OF TRIAL-RUN LABS. EDI has promoted Anderson to technology and engineering manager, with the new responsibility of coordinating trial runs in the film, extrusion coating, and slot die coating laboratories at the company's Technology Center in Chippewa Falls. ***The labs can be rented by companies for trials and product development.*** Anderson will also continue to oversee EDI's design engineering operation, ensuring that orders ship on time and working with customers to determine the optimum designs. "Jon has 35 years of experience in all phases of design and manufacturing at EDI and is exceptionally well qualified to work with customers in both of his areas of responsibility," said Gary D. Oliver, vice president of technology.

EDI ADDS NEW TECHNICAL PERSONNEL. Expansion of professional capability at EDI continues. Daniel Sullivan has joined the company as an process specialist in the new Technical Center at Chippewa Falls. He brings 19 years of experience in extrusion and thermoforming, chiefly with plastics processor GOEX Corp. He began there as a machine operator and moved on to responsibilities in process engineering and product development. Prior to GOEX, Sullivan worked for thermoformer Prent Corp. Also joining EDI is Cory Hutson, a new member of the engineering team. He has several years of design experience using advanced software and holds a degree in engineering technologies and mechanical design from the University of Wisconsin-Stout. Both Sullivan and Hutson report to technology and engineering manager Jon Anderson.

Technoscope *continued from P. 8*

the adhesive at its proper temperature, and apply it to the web substrate with a consistent coat weight (the amount of adhesive deposited on a given area of substrate). Several aspects of the coating system help to ensure this consistency:

'Pre-metered' hot melt delivery. The adhesive is delivered into the manifold at a constant, pulse-free rate by a positive displacement pump.

Application-specific manifold design. A chief reason why slot die coating is more accurate than roll coating is that each slot die is custom-manufactured in accordance with the flow properties, or "rheology," of the adhesive to be applied. Any given hot melt adhesive has its own rheology—a kind of fingerprint unique to the material (see article on page 3). For every slot die that it builds, EDI carries out an analysis of the flow properties of the adhesive to be processed and uses the resulting data in machining the complex internal geometry of the manifold. The result is uniform, predictable flow behavior inside the die, maximizing cross-web caliper control.

Ultra-flat lip surfaces. An exceedingly high level of lip flatness is essential for precision control of hot melt application. EDI can machine surfaces with a flatness of 0.5 micron over a length of 1 meter and confirm this parameter in a controlled-environment inspection cell. This facility is equipped with a granite surface plate certified as Grade AA for precision laboratory use and a non-contact linear flatness measuring system with resolution of 125 nanometers, or 5 X 10^{-6} in.

Stabilizing die positioner. For every slot die, EDI supplies an adjustable carriage that precisely positions the die at the optimum angle and proximity to the roll and isolates the die from vibrations that can affect coating application. It is a critical component for stabilizing the interaction between die and moving web. The coating process can be optimized by adjusting the angle of attack between die and substrate, the distance between the two, and the degree of offset between the lips of the die.

Fine-tuning of cross-web thickness profile. Dies are available with two adjustment systems:

1) industry-standard Ultracoat slot dies, which incorporate an adjustable or "flexible" lip for minimizing cross-web variations in coating thickness; and
2) a new "rotary rod" die for PSA applications, which employs a

Continued on P. 6

TURNKEY HOT MELT SYSTEM WITH GUARENTEED PERFORMANCE. EDI and ITW Dynatec offer a fully integrated system that applies any hot melt or PSA material over the full range of viscosities and at temperatures from ambient to 500 deg. F. (260 deg. C.). At right in photo is EDI's Modular Coating System, with slot die, positioning support, and idler and backing rolls. At left is complete melt delivery system from ITW Dynatec.

Increasing Demand for Hot Melts

While hot melts are used in markets such as the installation of flooring and the assembly of automotive and appliance components, there is a broad range of important uses involving the continuous application of hot melts to moving flexible substrates—webs—in roll-to-roll processes. The coating methods used in these processes typically involve open-to-the-workplace systems like roll coating and, increasingly, closed systems centering on slot coating dies.

There are two reasons why web-coating markets for hot melts are growing:

- ***Elimination of carrier fluids.*** Hot melts are 100%-solids formulations, and PSAs are increasingly moving from emulsion-based to 100%-solids as well. Such materials provide four advantages over conventional adhesives with solvent or water carrier fluids. 1) The standard solvents are volatile organic compounds (VOCs) subject to environmental, safety, and health concerns, as well as regulations. 2) The presence of carrier fluids entails added equipment costs for drying systems and—in the case of solvents—pollution-control devices. 3) Since hot melts are 100% solids, they are less costly than solvent- and water-borne adhesives, which lose half or more of their volume during application. And 4) since the carrier-removal steps are eliminated with hot melts, the coated substrate can immediately be post-processed, instead of being set aside as work in progress.

- ***Worldwide growth in major markets.*** Key web-coating applications for hot melts continue to grow in established economies and exhibit particularly rapid growth in developing countries as their standard of living increases. Besides flexible packaging, these end uses include applications for PSAs such as tapes, labels, and fastening tabs for diapers and other disposables. In addition, the continuing shift to online consumer shopping has created new demand by shippers for tapes, labels, and carton-sealing. Another high-growth market is healthcare, where PSAs serve in transdermal and other patches, and hot melts provide lamination in drapes, liners, and nonwovens.

Continued from P. 5. different means of ajustment. The rotary rod die is discussed in a later section of this article.

For Ultracoat dies, EDI supplies both manual and automated adjustment systems. In the latter, adjustments are made in accordance with information from a downstream thickness gauge. Automated adjustment makes it possible to hold coat weight tolerances to within +/- 3%. In roll coating, adjustment of the cross-direction coat weight profile is limited to average improvements over the whole width of the coating and seldom achieve tolerances better than about +/- 5%, regardless of target coat weight.

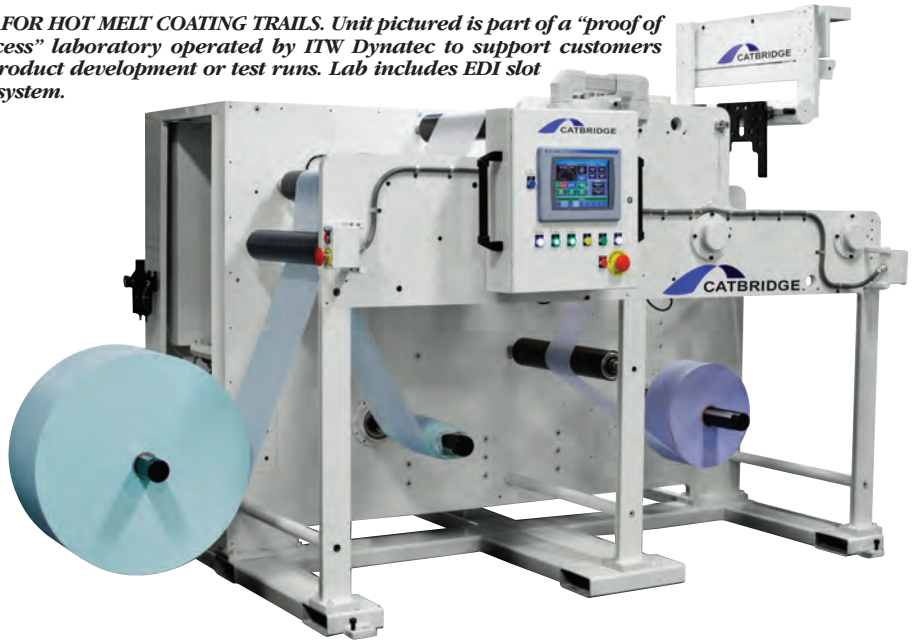
Closed System Cuts Emissions and Waste

While slot die systems directly control the amount of hot melt applied to a substrate, in roll coating the amount is controlled indirectly—by means of wiping blades or pre-set gaps between rollers. Only a portion (perhaps 50 to 80%) of the coating on the applicator roll is actually deposited on the web. The excess coating material is scraped away and returned to the coating bath.

While slot dies are completely enclosed systems, roll coaters are open to the workplace environment, acting as a source of workplace emissions. Because the fluid on the applicator roll is only partially transferred to the substrate, the remaining hot melt must be re-circulated. The resulting contamination damages product quality and leads to raw material waste. In addition, recirculation can cause thermal degradation of the polymers in hot melt, weakening its bond strength.

Roll coating is also limited in terms of productivity. Because roll coating allows only a partial transfer of coating fluid from an applicator roll to the substrate, at high speeds product defects can develop as a result of film splitting. Proper design of the die lips can prevent this film-splitting defect in slot die coating. Achievable speeds vary widely, based on the coating to be applied; in hot melt applications, conventional slot dies long available from EDI typically coat at speeds of 300 to 1000 feet/min. (91 to 305 meters/min.) but have been successfully run as fast as 1800 feet/min. (550 meters/min.). The corresponding high speed achieved by roll coating and other conventional hot melt application methods is 1200 feet/min. (365 meters/min.).

LAB FOR HOT MELT COATING TRAILS. Unit pictured is part of a "proof of process" laboratory operated by ITW Dynatec to support customers in product development or test runs. Lab includes EDI slot die system.



New Slot Die System for PSAs

A new slot die developed by EDI for PSA applications accommodates even higher line speeds while making possible coat weights as low as 0.5 mil (0.0127 mm)—well below the conventional lower limit for hot melts of 1.0 mil (0.025 mm). The die accommodates line speeds up to 2,000 feet/min. (610 meters/min.).

The method employed by the new die is contact coating, which involves applying the adhesive directly to a substrate, using the die lip to "wipe" the adhesive onto it. The keys to the advanced performance of the die are:

1) an innovative system for adjusting the cross-direction coat weight profile and
2) incorporation of a device that eliminates streaking and makes possible clear applications of PSAs.

Streaking is caused by gels or solid particles that lodge in the narrow lip opening and the interface between the die lip and substrate. In the new die, a motorized rotating rod in the lip area allows gels to pass through lip opening and coating interface.

At the same time, the new slot coating die includes a mechanism for adjusting the coat weight profile. Called a "restrictor bar," it is located between the manifold and the lip opening and spans the width of the flow channel. Coat weight adjustment is achieved by selectively turning bolts at regular intervals along this span to deform specific segments of the bar, inserting them into (or retracting them from) the melt stream and thus changing the height of the flow channel. This is a mechanism that has long since proven effective in dies for sheet extrusion.

Turnkey Hot Melt Coating Station

Another new development for hot melt application results from a cooperative program between EDI and **ITW Dynatec**, a specialist in hot melt delivery and application systems.

An agreement between these companies makes available to operators of coating and laminating processes a single, fully integrated system whose performance is guaranteed by the partner companies. The system can be designed to apply virtually any hot melt or PSA material over the full range of viscosities and at temperatures from ambient to 500 deg. F. (260 deg. C.). Depending on equipment parameters and the type of application, the system can coat at speeds exceeding 2,000 feet (610 m) per minute on wide widths, and in coat weights down to 0.5 mil (0.0127 mm) or less. Coat weight accuracy can be maintained within +/-1%.

The EDI portion of the coating station is a self-contained unit, called the Modular Coating System (MCS), which includes the new rotary-rod die; a robust, adjustable support for positioning the die lip with respect to the web; idler rolls; and a precision backing roll. These components are unitized within a steel frame whose crossbars maintain straightness during operation and adjustment.

A basic component provided by **ITW Dynatec** is the Dynamelt™ M-Series adhesive supply unit, or melter, which is

a self-contained system for melting the adhesive and pumping it to the applicator. The system includes a PLC controller with user-friendly HMI interface. Various melt rates, hopper capacities, and pump rates are available. The Dynamelt features a patented Melt-On-Demand™ Hopper which melts only the adhesive required and virtually eliminates adhesive char. Another adhesive delivery method used with this turnkey system is Dynatec's DM55 DynaDrum™ Bulk Adhesive Melter. The DM55 Drum Unloader features inflatable seals which accommodate various drum diameters, and removable platen faces allowing for field retrofit.

ITW Dynatec's Gemini™ Automatic Hot Melt Hose delivers the adhesive from the melter to the applicator. The patented Gemini™ Automatic hose has dual heater and temperature sensors that keep the coating line up and running in the event of a hose failure. If a hose fault occurs, Gemini switches to its back-up circuitry and an illuminated control box flashes, alerting the operator to change the hose during scheduled line-down time.

To support companies looking to carry out application development or test run slot die coating before investing in the EDI / ITW Dynatec turnkey coating station, **ITW Dynatec** has installed a new, high-speed hot melt web coating laboratory at its Hendersonville, TN facility.

A Better Way to Apply Hot Melts

Slot die coating has emerged as a more efficient and controllable alternative to roll coating and other conventional methods of applying hot melt adhesives to web substrates, particularly in view of today's market and regulatory forces. The intense competition generated by industry consolidation and globalization has increased pressure to maximize economy, productivity, and quality assurance. Quality is especially critical in medical and other high-end markets. At the same time, there is a growing mandate for further reductions in emissions of volatile organic compounds (VOCs) from solvent-borne coating systems. With slot die systems, operators of coating and laminating processes are well equipped to address these challenges. ◆

Improved Coating *continued from P. 1.*

for the buildup that causes die lines. The resulting reduction in downtime for cleaning and sharpening the lips translates into several whole days of added production over the course of a year, according to EDI technology manager Sam G. Iuliano.

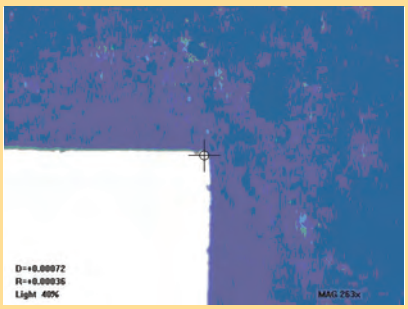
Now even more added uptime is within reach. "While tungsten carbide coating is inherently more durable than chrome plating, Praxair has improved the uniformity and quality of the coating, and EDI has perfected its processes for machining the smooth surfaces and sharp edges of the EverSharp lips," Iuliano says. "Now lip edges can last even longer and are shaper than ever, with the standard lip radius reduced from the 0.0015 to 0.0020 in. (0.04 to 0.05 mm) range five years ago to 0.0010 in. (0.025 mm)or less today."

The microphotograph accompanying this article, for example, shows a lip edge with radius of only 0.00036 in. (0.009 mm).

Improvements to Praxair's proprietary processes for applying tungsten carbide coating to wear surfaces have increased the density and uniformity of the coating and reduced the residual stress imparted as the coating is built up to a thickness appropriate for machining. In turn, EDI has made many improvements in its machining techniques, grinding wheel designs, and process controls since introducing EverSharp lip edges in 2004. Along with sharper radii, these advances have enabled EDI to produce more consistent and durable lip edges, with smoother finishes and better control over the transition between coating and base metal.

These improvements are expected to be particularly beneficial for products like biaxially oriented polyester (BOPET) film, glazing-quality sheet, film for electrode printing, and hot melts and other fluids applied by proximity coating.

"While the working life of tungsten carbide coated lip edges varies widely with the application, our experience has been that it is measured in years, during which chromium-plated edges will have undergone numerous re-sharpenings," said Iuliano. "By reducing the need to take the die off-line, EverSharp lip edges readily pay back the cost premium over chrome plated ones." ◆



***LIPS ARE SHARPER FROM THE START** because durability of tungsten carbide coating enables EDI to grind lip edges with exceedingly small radii. In this microphotograph, radius is only 0.00036 in. (0.009 mm).*

EDI Will Be There...

Interplastica (Jan. 26-29, Moscow): EDI to exhibit at stand of its agent, Invent Group.

SPE Polyolefins Conference (Feb. 21-24, Houston): Presentation by EDI's Gary D. Oliver: *Value Films from Sub-Micron Layers.*

CEMA Coating & Laminating Fundamentals (Feb. 23-24): Presentation by EDI's BJ Kays: *Pre-Metered Coating Methods.*

Intl. Rechargeable Battery Expo (Mar. 3-5, Tokyo): EDI to exhibit at stand of its agent, Kodama Chemical Industry.

ICE Shanghai (Mar. 17-19): EDI to exhibit at Stand 1-C05.

Argenplas (Mar. 22-26, Buenos Aires): EDI to exhibit at stand of its agent, Marcos Winograd.

Plastimagen (Mar. 23-26, Mexico City): EDI to exhibit at stand of its agent, ABC Plasticos.

Koplas (Mar. 30-Apr. 3, Gyeonggi-do, Korea): EDI to exhibit at stand of its agent, Daejoo.

Convertech Japan (Apr. 7-10, Tokyo): EDI to exhibit at stand of its agent, Kodama Chemical Industry.

Chinaplas (Apr. 19-22, Shanghai): EDI to exhibit at Stand L41, Hall 1W.

K 2010 (Oct. 27-Nov. 3, Duesseldorf, Germany): EDI to exhibit.

CPP Expo (Oct. 31-Nov. 4, Chicago): EDI to exhibit at Booth 9021, East Hall.

Slot Dies Increase Accuracy and Output in Hot Melt Adhesive Coating

by Sam Iuliano, Technology Manager

Worldwide growth in the use of hot melt adhesives has created a strong demand for equipment systems that provide consistent, streak-free application of adhesives at high speed and with minimal environmental impact. As a completely closed system that meters adhesives at precisely controlled rates, slot die coating meets all of these requirements. Recent advances have added to the advantages of slot die over conventional roll coating in terms of economy, productivity, and product quality.

Hot melt adhesives are polymeric materials, such as ethylene-vinyl acetate (EVA), polyamides, and polyurethanes, that are applied at elevated temperatures and chemically bond to the substrate as they cool. They are used in a wide range of manufacturing, including flexible packaging, paperboard, textile, and other continuous-web processes for which slot die coating is well suited. Continuous-web coating is even more widespread in the tape, label, nonwoven, and other industries that employ pressure-sensitive adhesives (PSAs). Considered a subset of hot melts, PSAs are typically rubbers or acrylate copolymers which are tacky at room temperature and physically bond to the substrate as pressure is applied.

This article will examine aspects of slot die coating that contribute to its superior accuracy, other advantages of this process over roll coating, and two recent advances in hot melt delivery and application systems:

1) An innovative slot die for PSA application that achieves coating thicknesses as low as 0.5 mil (0.0127 mm) at line speeds up to 2,000 feet/min. (610 meters/min.) while making possible clear, streak-free coating.

2) A completely integrated, computer-controlled hot melt coating system, incorporating melt delivery systems from **ITW Dynatec** and slot die equipment from EDI, that provides turnkey capabilities for tight-tolerance, high-speed application of virtually any type of hot melt adhesive.

Accuracy: Key to Quality, Productivity, Economy

Slot die coating helps users of hot melts conserve raw material and reduce costs, in part because of the accuracy with which it applies adhesives—even at high line speeds. In comparison with roll coating and other conventional systems for hot melt application, slot die coating provides a much greater degree of precision and consistency. This control yields improved quality assurance, allows higher line speeds, and opens opportunities for conserving raw materials by maintaining tighter tolerances.

The function of the slot die is to distribute the incoming stream of hot melt to its target width, maintain *Continued on P. 5.*

NEW DIE RUNS PSAs 'THIN AND FAST.' Easily visible in the lip area of this die is a motorized rotary rod that allows gels to pass through the lip opening and the coating interface, preventing buildups that cause streaking. Another new feature, inside the die between the manifold and the lip opening, is a restrictor bar for adjusting the coat weight profile. The die makes possible coat weights as low as 0.5 mil (0.0127 mm) and line speeds up to 2,000 feet/min. (610 meters/min.).

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