

Special NPE Issue – Visit EDI at Booth 4661



EDI

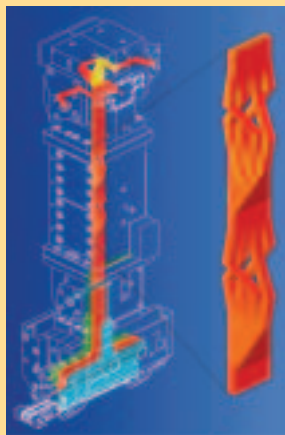
# Advances

News and Concepts from Your Global Partner in Extrusion, Coextrusion & Converting

ISSUE NO. 14

## 'Layer Multiplier': Better Coextrusions at Lower Cost

At NPE 2006, EDI will announce micro-layer technology that makes it possible to coextrude film and coatings of standard overall thickness but with vastly more layers than is achievable in ordinary processing. The "flow stacking" that produces the microlayer structure of these products increases their impermeability to moisture and gases, encapsulates gels and "un-melts," and enables manufacturers to make more economical use of high-performance materials.



The result is increased line productivity and improved end-use performance, along with greater scope for reducing costs.

The technology is based on a patented "layer multiplier" system developed by The Dow Chemical Company and licensed from Dow by EDI. In a typical configuration of the system, three or more extruders feed melt streams into an EDI-streamlined feedblock, which produces a uniform multi-layer "sandwich"; this in turn is fed into a layer-multiplier device built by EDI using Dow's patented design. In this device the layers are multiplied in stages—for example, three layers are multiplied into twelve, which are multiplied into forty-eight (see schematic). The finished micro-layer structure is then

*Continued on P. 2.*

## At NPE 2006: 'Great Leap Forward in Productivity' for Users of EDI Dies

Visitors to the EDI exhibit at NPE 2006 will discover flat die innovations that provide dramatic increases in productivity and end-product value. Consider, for example, a new die that cuts adjustment times by orders of magnitude. Or coextrusion technology that yields barrier film with up to 80 layers.

"EDI innovations since the last NPE have followed many paths, but they all constitute a great leap forward in productivity for extrusion processors and web converters," says Christopher W. Curtin, executive vice president of marketing and sales. "At NPE 2006, we will display die systems that increase versatility and reduce downtime, giving manufacturers the capability to run lean or handle many small orders while maintaining profitability. Other innovations make possible new coextruded structures that add value to existing end products and even make possible new ones."

NPE 2006 will take place June 19-23 at Chicago's McCormick Place. In addition to executive VP Curtin, EDI peo-

ple present at the company exhibit (Booth 4661) will include Timothy C. Callahan, president and CEO, John A. Ulcej, executive vice president of engineering and technology, and EDI's team of sales engineers, product managers, and customer service manager. Leading themes of the exhibit will include:

### ● **Contour Die™: a New Standard.**

The fundamentally new Contour Die dramatically reduces the time needed for adjustment at the start of each production run or change in extrusion parameters, and it does this without compromise of flow streamlining. At NPE

2006, EDI will announce that all new dies for cast film will be of the Contour Die design (see p. 4) and will introduce a new customized "R-bar" version for sheet applications.

### ● **'Custom-Engineered Die Systems™':**

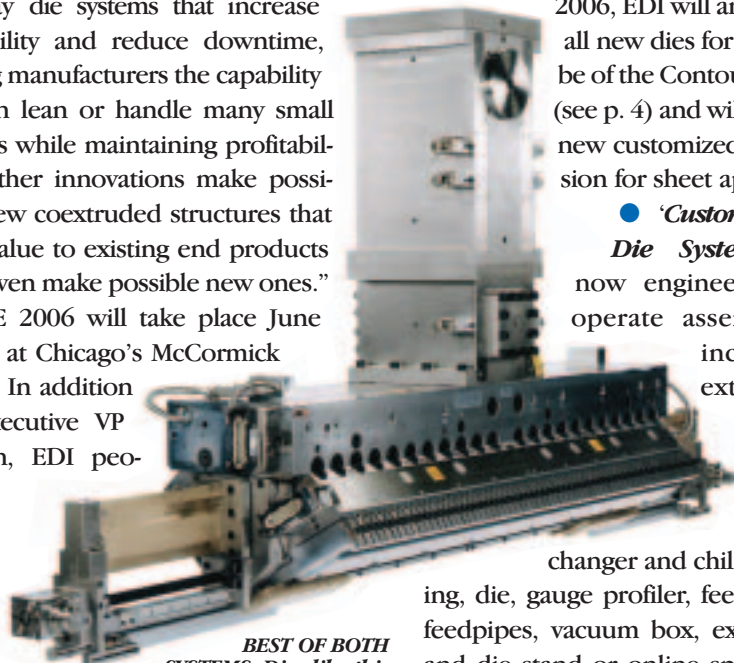
EDI now engineers ready-to-operate assemblies that include every extrusion tool-

ing component between the screen

changer and chill roll, including, die, gauge profiler, feedblock, melt feedpipes, vacuum box, exhaust hood, and die stand or online splitter (see p. 3). "By integrating all components into a single cus-

*Continued on P. 3.*

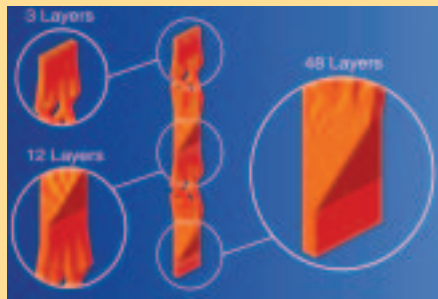
**BEST OF BOTH SYSTEMS: Dies like this 3-manifold Ultraflex® with distribution block and feedblock are advantageous for higher numbers of layers.**



### 'Layer Multiplier' *continued from P. 1.*

distributed in an EDI coextrusion manifold to the target product width.

"We still do not know the practical upper limit," says EDI president and CEO Timothy C. Callahan, "but in my opinion it is possible to produce 50-micron film with 80 layers."



**MICROLAYERS IN 3 STAGES:** In Dow-design layer multiplier, 3-layer "sandwich" from feedblock is transformed into 12 layers, then 48. Another sample sequence: 5-20-80.

EDI's microlayer technology integrates the Dow layer multiplier into a complete custom-engineered system that includes the die, feedblock, and other components for distributing the complex structure into a finished extrudate. The company will license the Dow technology to customers. "We are establishing relationships with licensees that enable processors to profit from the production economies and enhanced product performance made possible by the EDI / Dow multiplier system," Callahan says.

### Why Multiply a Structure That's Already Multi-Layer?

As coextruded structures proliferate well beyond the standard five, seven, or nine layers, here are some of the benefits cited by EDI:

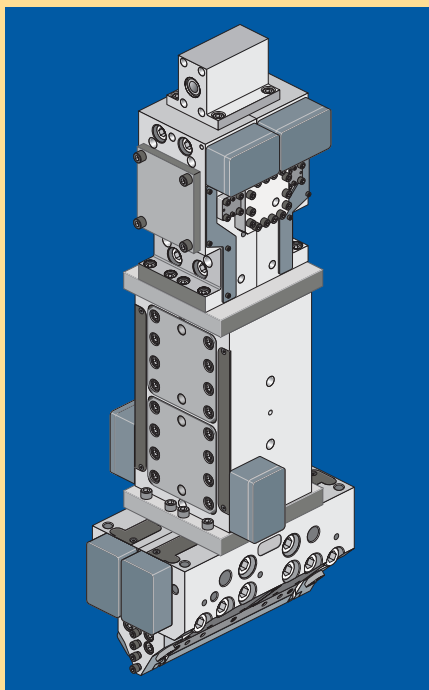
- **Enhanced barrier properties.** The sheer increase in the number of barrier layers in the product yields an even more "torturous path" for gas and moisture molecules.

- **Economizing on costly materials.** Because many key properties of a polymer do not decrease proportionately with layer thickness, microlayer technology makes it possible to economize on costly high-performance resins while still achieving target properties. In oriented PET film, for example, layers of more expensive high-intrinsic viscosity (IV) resins can be

combined with layers of low-IV grades. The resulting film properties are superior to those of film produced from a physical blend of high-IV and low-IV PET grades.

- **Fewer web breaks.** The greater the number of layers, the less the likelihood of breakage caused by pinholes in film, particularly in biaxially oriented products subjected to post-extrusion stretching. This is because the large number of layer-to-layer interfaces increases the chances for gels and other defects to be encapsulated and rendered harmless.

- **New combinations of properties.** The same polymer exerts different effects on end product properties according to whether it is distributed into one or two layers or into many super-thin layers. Layer multiplier technology makes it possible to produce film that is more flexible, for



**MICROLAYER TOOLING:** EDI engineers complete system to maximize streamlining, accommodate viscosity differences, and ensure dimensional consistency. Schematic shows feedblock (top), Dow-design layer multiplier (center), and multi-manifold die (bottom).

example, without reducing the overall amount of a rigid polymer used as one of the raw materials. One benefit is greater processing latitude in subsequent thermoforming processes.

"EDI sees much of the barrier packaging sector adopting layer-multiplier technology," Callahan says. "Microlayer coex-

trusion also promises to speed the incorporation of nanocomposites in food packaging for enhanced barrier, thermal, and mechanical properties."

### Technology Already Commercially Proven

Dow's patent history for its layer-multiplier technology goes back many years,



**FEWER WEB BREAKS** occur with microlayer film because gels and other defects are more likely to be encapsulated, as shown here.

and the technology is being used very successfully by 3M Corp. for a wide range of sophisticated optical films in electronic screen displays and other products. Excluding such polymeric reflective films, the license granted to EDI applies to cast film, oriented film, sheet, and extrusion coating, primarily focused on packaging.

The Dow technology is the best system available for extruding micro-layer products, according to Callahan. "Because layer multiplication requires that a layer structure travel a greater distance than in conventional coextrusion, there is a greater tendency toward viscous encapsulation of one layer material by another," he says. "The Dow technology meets this challenge more efficiently than other systems."

The tasks carried out for each customer by EDI will include: 1) designing feedblocks to present the proper layer structure to the multiplier device, 2) engineering the multiplier device to provide the pressure drops and balanced polymer flow channels for combining materials of differing viscosities and flow rates, and 3) machining streamlined manifolds to distribute the microlayer structure to final width. To carry out this work at its Chippewa Falls, WI, U.S.A. world headquarters, EDI has built a 2,000 sq.ft. (190 sq.m) process development laboratory equipped to run a wide range of film and sheet structures. ◆

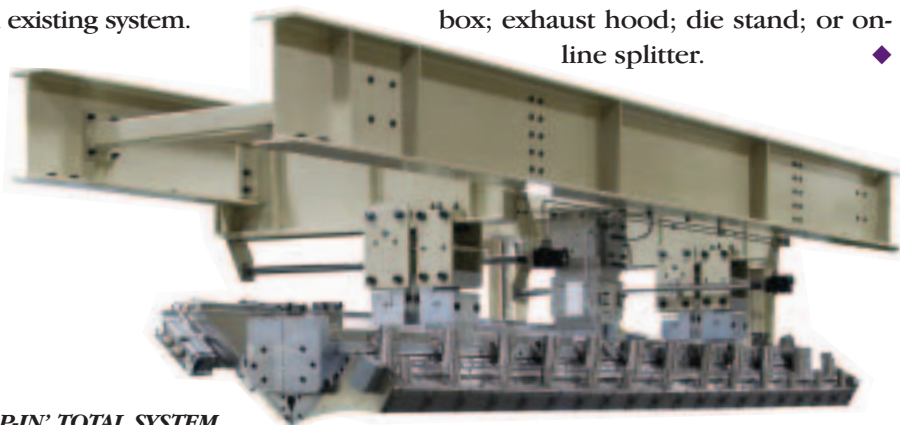
# Total Die System Concept Will Debut at NPE 2006

**E**DI now engineers complete extrusion tooling systems that enable machinery OEMs, processors, and web converters to single-source every component required for transforming molten polymer into film, sheet, and coatings.

In accordance with the Custom Engineered Die System™ concept to be introduced at NPE 2006, EDI designs and builds ready-to-operate assemblies for installation between the screen changer and the equipment downstream of the die lip exit. By integrating all critical die-related components in a single system that is custom-engineered for a specific application, EDI can help OEMs and processors speed up the engineering of a new extrusion production line or a retrofit of an existing system.

The die is the heart of the extrusion process. By integrating the die with all of the components that work with it in distributing polymer into a finished extrudate, the Custom Engineered Die System increases the efficiency of the entire production line. This optimization is particularly important for today's increasingly complex extrusion runs, where a die is fed by as many as eight to nine extruders to yield a single barrier film or other structure of up to eleven layers.

While the Custom Engineered Die System varies with the application, one system may include any or all of the following: flat die or coating head; gauge profiler; feedblock; die subsystems such as deckle or FastGap; melt feedpipes; vacuum box; exhaust hood; die stand; or on-line splitter. ◆



**'DROP-IN' TOTAL SYSTEM** simplifies engineering of new extrusion lines for OEMs and processors. This 215-in. (5,460-mm) Contour Die™ stretch film system is shown mounted on UltraSplit™ die stand and splitter. Top of nine-layer Ultraflow™ I-S coextrusion feedblock is concealed from behind the top beam of the splitter. In foreground are the vacuum box (close to die body, with long vertical pipes protruding) and the smoke hood (farther from the die body, with shorter vertical pipes protruding). Oblique structure partially visible on the opposite side of the die is Autoflex® VI-R gauge profiling system.

## Visit Our NPE 2006 Booth and Be a 'Double Winner'

With so much new technology to discover, you cannot lose by visiting EDI's NPE exhibit (Booth 4661). And for a chance to be a winner twice over, be sure to enter our raffle while you are there. We'll draw a winning entry at the end of each of the first three days of the show (Monday through Wednesday).

Try your luck at winning one of these really useful (not to mention cool) prizes:

- Bose Quiet Comfort 2® acoustic noise-canceling headphones
- Apple iPod® 30 GB music player
- Canon ZR600 MiniDV Digital Camcorder

**NPE 2006** *Continued from P. 1* tomized 'drop-in' system, EDI can help extrusion OEMs and film, sheet, or coating producers speed up the process of specifying and engineering an extrusion line," says Curtin.

● **'Layer Multiplier' for coextrusion.** Technology licensed from The Dow Chemical Company enables EDI to provide coextrusion systems that yield microlayer products of standard thickness but with as many as 80 layers (see p. 1). As a result, extrusion processors can enhance barrier properties, reduce product defects, and achieve new economies in consumption of costly layer materials, according to EDI president Callahan. "We expect microlayer technology to revolutionize barrier film," he says.

● **Layer Proliferation in Barrier Film.** Even without microlayer technology, producers of barrier film are shifting to structures with higher numbers of layers. "To support these manufacturers, EDI has taken a different approach from competitors," notes VP Ulcej. "Because of our extensive experience with both feedblocks and multi-manifold dies, we not only offer a choice between them but design systems that combine the two. Feeding two or more multi-layer substructures from a feedblock into a multi-manifold die is particularly effective for products with very high layer numbers."

Typically, a multi-manifold die accommodates five or more layers, and additional layers can be added by means of a feedblock. "Because the layers in a multi-manifold die are combined after they have been distributed to target product width, there is better control over layer-to-layer variations than with a feedblock, which combines materials before distribution to full width," says Ulcej. "This is especially important when you are running materials with significantly different viscosities or processing temperatures. And by using internal deckles to reduce the width in the manifolds processing barrier and tie layers, it is possible to keep these materials out of edge trim, making it more reusable." ◆

# Contour Die: Now Standard for Film and Available for Sheet

**A** revolutionary die that yields thousands of pounds of additional saleable product with each new job run or throughput change is now the standard for all cast film systems shipped by EDI and can be modified for use in sheet extrusion as well.

The Contour Die™ has become the preferred die for EDI's cast film customers, who have ordered nearly 90 units since the concept was introduced three years ago, according to Sam G. Iuliano, product manager for the cast film industry. "In extensive use for commercial production, the Contour Die has in some instances reduced the time to adjust for changes from one product to another from 40 minutes or more to five minutes or less, yielding large quantities of good, saleable film that would normally have been scrap," says Iuliano.

The deflection cited by Iuliano refers to distortions in the die gap caused by changes in material viscosity or throughput rate with switches from one product to another. Because the pressures inside the die are high, these changes cause the heavy steel die bodies to deflect. In a conventional cast film die, the deflections are non-uniform, typically causing the lip gap to open more in the center than at the ends and producing the distortion commonly called "clam-shelling." In designing the Contour Die, EDI solved this problem by giving the die a unique

"sculpted" shape, thicker in the center than at the ends, that produces uniform deflection.

"With each product changeover, the operator of a conventional die typically must offset non-uniform deflection by shutting down the automatic gauge profile control (APC), manually adjusting the lip gap, and then restarting the APC for final tuning," says Iuliano. "With the Contour Die, the APC itself is often sufficient for adjusting the die to dramatic changes in material viscosity or throughput."

Over a year's time, this increase in productivity and reduction in scrap can yield substantially improved profitability for the film manufacturer, according to Iuliano. "By eliminating much of the penalty incurred with job changes, the Contour

Die enables film companies to compete effectively in a marketplace increasingly characterized by short run times for highly customized films," says Iuliano. "And since the clam-shelling problem increases with width in a conventional die, there are

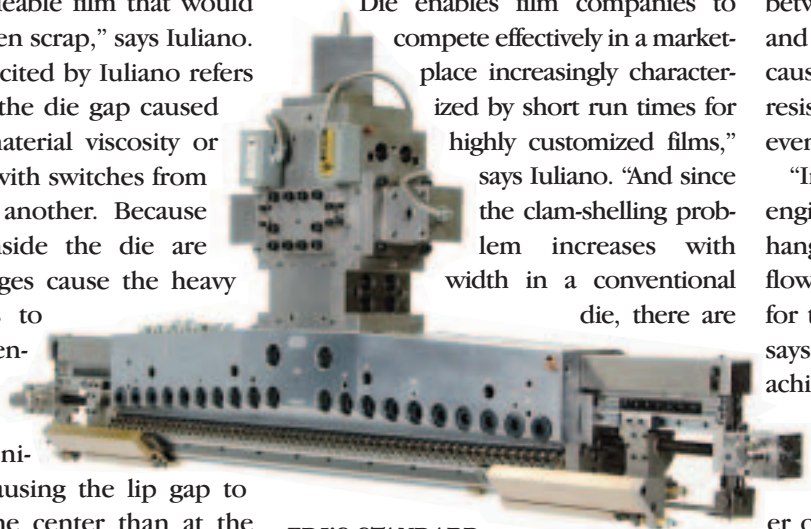
special benefits for companies that employ very wide dies."

## Key Is Uniform Deflection Plus Streamlined Flow

The concept of changing the overall shape of the die from the usual block-like configuration is a radical departure.

While the workhorse manifold for cast film has been the "coat-hanger" (so called because of the triangular shape of the flow channel), designers first attempted to solve the clam-shelling problem with a "broad shoulders" manifold shaped so that the bolts clamping together the two die bodies were arranged in a straight line. This design yielded uniform die body deflection—but at the cost of flow streamlining. Molten polymer—particularly highly elastic material—tended to stagnate in the corners at each end of the manifold. The difference in residence time between material exiting from the center and material exiting from the ends could cause variations in strength or puncture resistance across the width of the film, or even yield discoloration at the ends.

"In designing the Contour Die, EDI engineers started with a standard coat-hanger manifold to ensure streamlined flow and then developed a new shape for the die bodies enclosing it," Iuliano says. "Besides making possible rapid achievement of target gauge, the resulting combination of uniform deflection and streamlined flow provides greater leeway for increasing extruder output without compromising product quality and consistency, reduces the possibility of polymer degradation and gels, and speeds up purges for color or product changes. ♦



**EDI'S STANDARD CAST FILM DIE is now the Contour Die™, whose body has a unique sculpted shape that reduces adjustment time for job changeovers without sacrificing flow streamlining.**

### INSTANT ACCESS TO EDI [www.extrusiondies.com](http://www.extrusiondies.com)

For more information, readers of EDI ADVANCES are invited to visit our web site at the address above. We also welcome your e-mail, which you can post from the web site or by keying in our [sales@extrusiondies.com](mailto:sales@extrusiondies.com) address. The web site is your resource for information on:

- EDI dies, feedblocks, decking systems, vacuum boxes, die carts, and related equipment.
- Sales, technical service, customer service, spare parts, and other departments.

- Agents in our worldwide sales & service network.
- Remanufacturing facilities in the U.S.A., Germany, and Japan.
- Visiting EDI headquarters.

**Extrusion Dies Industries, LLC** is a leading international supplier of flat dies for sheet and film, coating, and pelletizing. We draw on extensive engineering capabilities to design systems that are highly tailored to specific customer needs. Headquartered in Chippewa Falls, Wisconsin, U.S.A., we sell half of our dies to customers in other nations around the world.

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