

Trend Report. Makers of equipment and components for producing film showed at K2013 that there is still scope for innovations, even in a mature technology like film extrusion. Novelties both large and small are boosting production line efficiency while enhancing film quality.

A Sector with Plenty of Potential

Makers of blown film extrusion lines presented their latest developments for enabling customers to run versatile, efficient film-production operations. Thus, high output no longer is the main focus of the innovations presented. Instead, the machine makers are placing a strong emphasis on line versatility, production of premium film, energy efficiency and user-friendly controllers.

Versatile Blown Film Extrusion

Windmüller & Hölscher KG, Lengerich, Germany, presented the Varex II, a substantial upgrade to its proven Varex concept (Fig. 1). The new Arctis air ring is made of GRP and features an optimized air flow concept for maximum cooling of the film bubble. Its integrated design also provides easy access to the die components. The Maxicone series of dies can accommodate up to eleven layers and keeps pressure losses low while achieving high output rates. When they are used in conjunction with the extruders' performance- and flow-optimized barrier screws, output can be boosted to up to 1,500 kg/h.

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Fig. 1. The air ring of the Varex II blown-film line is made of GRP (figure: Windmüller & Hölscher)

The lateral guide elements in the bubble collapsing unit are automatically adjusted to improve film flatness and minimize film curvature. The new Filmatic S II winder can be tailored to any application and features a comprehensive range of optional equipment. The central controller accurately evaluates and records

the energy usage of the individual components via the Energy Monitoring module. Windmüller & Hölscher also demonstrated an Optimex blown film line whose versatility and high efficiency are optimized for the production of 3-layer films.

Energy efficiency also featured at the booth of **Hosokawa**

Alpine AG, Augsburg, Germany. The ExVis 2.0 controller of its 5-layer line at the show can display the energy usage of the various line components so that they can be evaluated and optimized. The line has a 400 mm die and can produce at up to 1,000 kg/h. For five days of the show, visitors were able to appraise the MDO 20/11 stretching unit working in conjunction with the patented Trio system (Trim Reduction for Inline Orientation). The Trio system reduces edge trim in the stretched film by up to 50 % through specific adjustments to the thickness profile. Hosokawa Alpine also presented a new 11-layer-film die head from the compact X series (Fig. 2). Another novelty was the Alpine ATW double winder which boasts a 2-meter working width and a space-saving stack configuration that supports reverse winding and adhesive-free initial winding.

For its part, **Reifenhäuser Kiefel Extrusion GmbH**, Worms, Germany, showed off its patented Evolution Ultra Flat system, which is positioned between the haul-off and the turner bar system. It is positioned after the haul-off because the film is still warm there and still not fully crystallized as it is being stretched. The resultant improved film quality supports further processing at high speeds. The advantages of the Evolution →



Fig. 2. Eleven-layer die-head from the X-series (figure: Hosokawa Alpine)



Fig. 3. The Evolution Ultra Stretch unit (figure: Reifenhäuser Kiefel Extrusion)

Ultra Flat system also feature in the Evolution Ultra Stretch unit (Fig. 3). The Evolution Ultra Cool vertically adjustable air ring, in conjunction with internal cooling and conical internal mandrel, boosts cooling performance, especially inside the bubble, and so ensures that the film is uniformly cooled. Thanks to a torque controller on the prewinder, the new Evolution Ultra Range winder yields rolls of enhanced quality. In its greatly expanded technical center in Troisdorf, Germany, Reifenhäuser Kiefel Extrusion also presented a 3-layer blown film line which produces films composed of highly filled polymers and which utilizes a Reitruder for the middle layer.

Eleven Layers for High Barrier Packaging

Kuhne Anlagenbau GmbH, Sankt Augustin, Germany, presented a new 11-layer concept for all three of its Smart Bubble, Bubble Cool and Triple Bubble product ranges (Fig. 4). The basic idea is to design all eleven extruders and all eleven layers in the same way. New screws and barrels for the extruders support the process-

ing of all common raw materials on every extruder. The melt pressures are kept stable with melt pumps to ensure uniform layer distribution.

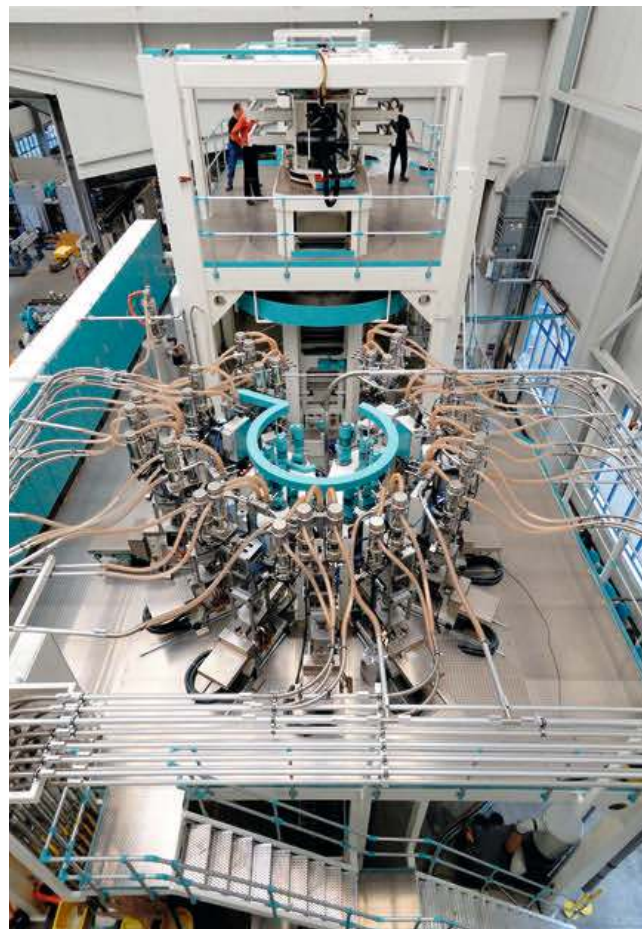


Fig. 4. The new 11-layer concept utilizes the same design for all eleven extruders (figure: Kuhne)

The new line concept is especially beneficial for Triple Bubble machines for high barrier packaging because of its great versatility and the large

number of layers. The Smart Bubble product range now features a new, longer collapsing unit which, in conjunction with microporous turner bars and annealing sections in the haul-off, improves film quality. The die head and the internal cooling system have also been modified to reduce the rate of condensate deposition.

Macchi S.p.A., Varese, Italy, presented its CR-K3 air ring made of carbon fiber-reinforced plastic for enhanced air flow and thus higher output rates (Fig. 5). A new collapsing unit and annealing station ensure that the film presented for winding is of the optimum quality. The line's turner bar system has been made more compact, allowing approx. 1.5 m to be shaved off its height.

A 3-layer blown film line capable of producing up to 750 kg/h was presented by Dolci Extrusion S.r.l., Biassono, Italy. The new SXO Magnum winder for film widths of 2,200 mm has a taper tension system and supports gap winding. The new internal-cooling controller features software for simplifying product changes.

Measures to reduce condensation in the air rings have



Fig. 5. The CR-K3 air ring of carbon fiber-reinforced plastic improves air flow and increases productivity (figure: Macchi)

been implemented by **Plast-Control GmbH**, Remscheid. A special coating applied to the lip of the Magic Flow air ring prevents condensation. The ProCon Duo series of double-stacked air rings has an air-evacuation unit on the upper cooling ring that suppresses condensation formation. The air rings also improve the mechanical properties of the film by virtue of the cooling conditions created by a special air flow system.

New Calibration Basket Concept

The Centro-M from **Kdesign GmbH**, Königswinter, Germany, is a new calibration basket concept that dispenses with swivel arms and instead uses individual actuators to radially adjust the guide elements (Fig. 6). This permits the position of each segment to be

monitored and controlled, and so improves centering of the film bubble. In addition, the Centro-ES monomer-extraction unit integrated into the basket reduces the formation of condensation. The company has specifically developed what it calls the Centro MAC air calibration system, which guides film with tacky, sensitive surfaces contactlessly on air cushions. Kdesign also presented the K-Vision AC contactless profile measurement system.

Octagon Process Technology GmbH, Würzburg, Germany, presented the Eco screwfeeder, which supports full gravimetric metering of small quantities at an affordable cost. It is ideal for functionally upgrading cheaper systems to ensure recipe compliance. The Triple-Lip air rings from the SmartLip series can improve the mechanical proper-

ties of long-neck film, even in the case of LDPE. An air volume gauge controller ensures compliance with low gauge tolerances.

Raw Material Savings in Cast Film Extrusion

The same trends are to be found in cast film extrusion. Packaging is still the largest market here, with raw materials accounting for up to 80 % of costs. Consequently, any small savings on raw materials that result from improved production technologies tend to have a huge impact on film

asymmetric layer distributions with up to 15 layers are achievable. Asymmetric distribution optimally exploits the functionality of specific layers (e.g., the sealing layer) at its position in the composite. As a result, the total number of layers can be reduced. Mirex MT is a new polishing stack technology that enables film producers to adjust the polishing nip more precisely by a factor of ten. The mechatronic drive unit, which combines low-backlash planetary gearboxes with servo motors and torsion-resistant couplings, was inspired by CNC

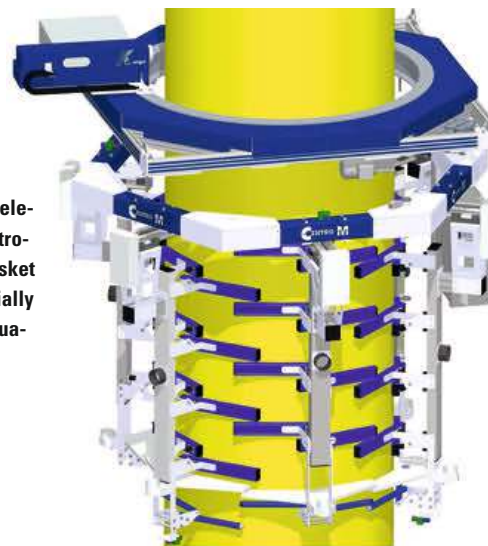


Fig. 6. The guide elements of the Centro-M calibration basket are adjusted radially by individual actuators (figure: Kdesign)

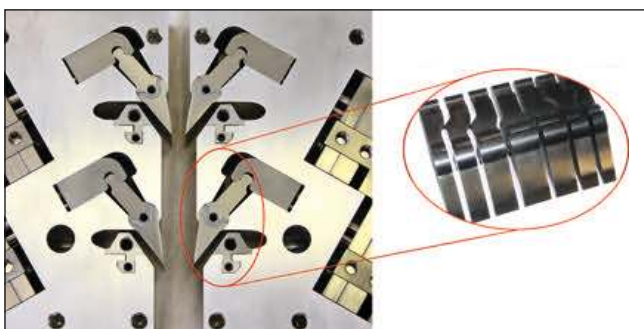


Fig. 7. The Reicofeed 2.1 coextrusion feed block has segmented profilers for optimizing the individual layer thickness tolerances (figure: Reifenhäuser CSC)

producers' balance sheets. It is therefore always worth investing in modern technology and extrusion systems.

There were plenty of exhibits to look at on the booth of **Reifenhäuser Cast Sheet Coating GmbH & Co. KG**, Troisdorf, Germany. The further optimized Reicofeed coextrusion feedblock 2.1 supports adjustment of the individual layer thicknesses during ongoing production, for example. Seven segmented profilers correct the layer thickness distribution in the feed block (Fig. 7). This facilitates production of film with very narrow individual-layer gauge tolerances and opens up scope for savings on high-priced raw materials for the functional layers. Both symmetric and

machine tools. Unlike before, adjustments can now be made during running production. The position of the polishing rolls is 100 % reproducible and so lends itself to automation. The uniform thickness profile permits savings on raw materials. Setup times are reduced and the energy balance of the polishing stack has improved because there are no longer any hydraulic pumps in permanent operation.

A high-speed extrusion line for PP film in a thickness range of 200 to 2,500 µm and featuring the new Multi-Touch roll stack was presented by **battenfeld-cincinnati**, Bad Oeynhausen, Germany/Vienna, Austria (Fig. 8). The compact 75-millimeter extruders reach outputs of up to



Fig. 8. The Multi-Touch polishing stack uses just two large cooling rolls, but has five added post-cooling rolls (figure: battenfeld-cincinnati)

1,500 kg/h for PP and up to 2,000 kg/h for PS. The polishing stack operates with just two large chill rolls, but with the addition of five post-cool-

shafts per turret. This speeds up switchover when rolls need to be changed. The provision of four shafts permits simultaneous loading with new



Fig. 9. The Smart Cast system for stretch films can produce film at a rate of up to 1.5 t/h in a thickness of 12 µm (figure: SML)

The second Filmex line on display produces a 33-layer, 12 µm composite film in a width of 3,000 mm using seven extruders (Fig. 10). It has an

and ensuring trouble-free operation.

Better Mechanical Properties through Inline Edge Folding

Torninova S.r.l., Perugia, Italy, demonstrated the production of a three-layer, 10 µm stretch film characterized by high strength and extensibility (Fig. 11). It supports easier and securer wrapping of packaged goods while consuming less material. The Compact Stretch 1000 facilitates production in various formats. During ongoing production, film gauge in the range 9 to 12 µm can be switched to 17 to 23 µm. A new technique shown by Torninova is that of inline edge-folding. This reinforces the edges and so improves the mechanical properties. For hand-stretch rolls, this has the advantage that the film will not be damaged if the roll falls on its edge.



Fig. 10. Filmex cast film line with nano-layer feed block for the production of stretch film (figure: Windmüller & Hölscher)

ing rolls. In this way, uniform cooling and calibration of the sheet are achieved on both sides. The outcome is premium-quality, virtually tension-free sheet with extremely narrow thickness tolerances.

Faster Roll Changes

SML Maschinengesellschaft mbH, Lenzing, Austria, put on a demonstration of its new SmartCast line (Fig. 9). This turns out 5- or 7-layer stretch films on a working width of 3 meters, and is capable of producing 12 µm film at speeds of up to 1.5 t/h. Not only has the chill roll unit been optimized, but the production line is equipped with the new W4000-4S winder with four

cores and removal of product. The winder is suitable for films up to 6 µm thick and 1 to 4 m wide. Thin cores and automatic core and roll handling are also feasible.

Films for sterilizable stand-up pouches are mass-produced goods that are enjoying high growth rates. Consequently, the economics of production are crucial here. The Filmex line in the pilot plant run by **Windmüller & Hölscher** produced 5-layer CPP film for this application in a working width of 2,000 mm at a rate of about 500 kg/h. The salient feature here is the reduced film thickness of 60 µm, which represents a raw material saving of 25 % compared to that of conventional production.

output of around 1,200 kg/h. The film is used on high-speed pallet stretch-wrapping systems. It is characterized by high extensibility values and process reliability, and cuts costs by saving on material



Fig. 11. Line for producing 3-layer stretch film (figure: Torninova)



Fig. 12. This chain guide capable of 1,088 m/min is the first step toward achieving the stated production goal of 1,000 m/min (figure: Brückner)

Brückner Group GmbH, Siegsdorf, Germany, focused on the topics of enhanced line performance, energy efficiency and high-performance films. It offers optimized high-speed stretch lines, high-speed extrusion systems and the new LISIM generation as just some solutions in these key areas. Visitors to its booth were shown the company's vision for the future. Its goal is a production speed of 1,000 m/min. A chain guide moving at 1,088 m/min showed that Brückner has already taken the first step toward reaching this goal (Fig. 12). However, the line stability is essential if production reliability is to be assured. Consequently, further line components, such as the winder, are being optimized. Further development of raw

new generation of cast film die (Fig. 13). This combines fast, precise gauge adjustments with a new internal decking system. The "coathanger" manifold needs less time to achieve on-spec product and to purge between product runs. Furthermore, it offers up to 25 % improvement in cross-directional product uniformity. Material savings and higher

Cloeren Inc., Orange, Texas/USA, also presented its latest development in the field of cast film dies. The moebius-manifold die comes in three different configurations for mono films and coextruded films and incorporates an internal decking system. The manifold has a decreasing cross-sectional profile with different aspect ratios. The teardrop-shaped cross-section



Fig. 13. The Contour cast film manifold allows rapid changes in product width without the need to shut down the line (figure: EDI Nordson)

materials in cooperation with raw materials producers is another necessary step for achieving the stated goal.

New Die Concepts

Nordson Extrusion Dies Industries LLC, Chippewa Falls, Wisconsin/USA, unveiled Contour, a

productivity are thus possible. The die has a "sculpted" configuration, which is smaller and tapers at the ends. This shape offsets the differences in pressure-induced die-body deflection across the width of the manifold. Changes in the shape of the product are thus avoided.

tion tapers from the center to the end of the manifold (Fig. 14). The manifold length remains constant because the transition angle between the manifold and lip land varies. The die lip and the start of the manifold are parallel, with the result that differential clamshell deflection is reduced or even eliminated.

Conclusion

The machine makers presented a diverse range of lines for mass-produced and specialty film products. With regard to the production of premium-quality films, concepts for improving film quality and optimizing production are increasingly emerging. However, machine makers are also focusing on topics such as ergonomics and energy efficiency. Overall, it was evident from the show that there is plenty of potential in the sector and that the advances made have not just been of a cosmetic nature. ■

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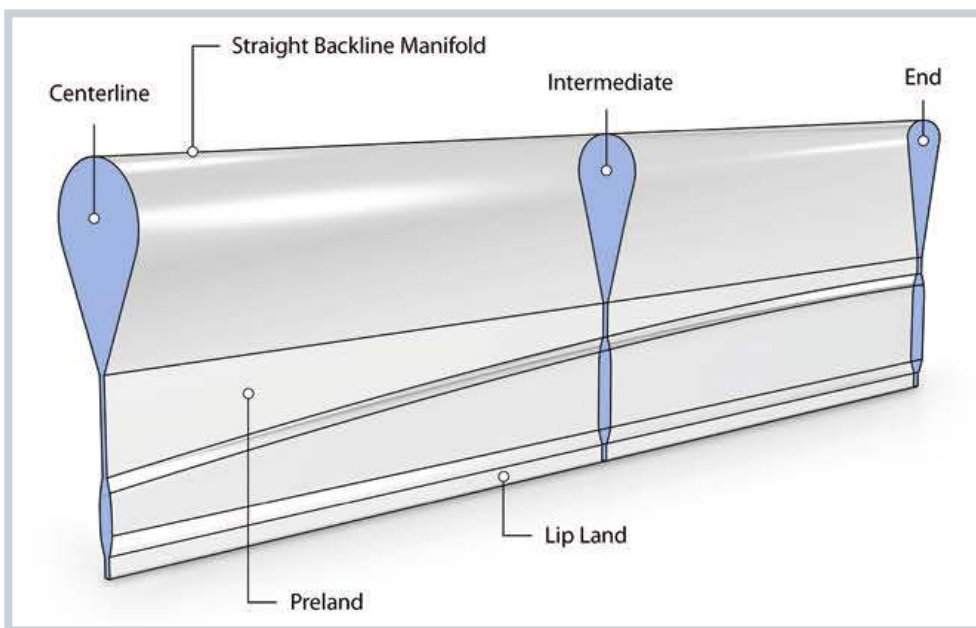


Fig. 14. Extrusion die with moebius manifold. The teardrop-shaped cross-section tapers from the center to the end of the manifold (figure: Cloeren)