

Films. Again this year, the offering in line designs and retrofit solutions was enormous. Suppliers awaited the fair with foreboding. But following the fair, they all wore a look of satisfaction. Full order books and a high level of interest confirm that recovery is on its way after a time of economic turbulence.

Multi-Layer, Efficient and Sustainable

The most significant trends include extruders capable of processing a wide-ranging portfolio of materials without a screw change as well as continued increases in the output from blown film lines. There are also indications that blown film line suppliers are promoting the development of high-performance composite films. Line designers are pushing for film solutions with more and more layers in order to make more effective use of materials and to tailor film properties at the same time.

Blown Film Extrusion

The fair record of 1,000 kg/h throughput was set on site by **Windmüller & Hölscher KG** (W&H), Lengerich, Germany. Its 5-layer blown-film line extrudes through a die 400 mm in diameter (**Fig. 1**).

This line is equipped with five low-temperature extruders (70/70/105/70/70.30D) for producing polyolefin multi-layer film. In contrast to conventional 5-layer lines for barrier films, the thickest layer here is the middle one. A clever combination of different polyolefin types enables better mechanical properties. Another novelty besides the 5-layer blow head reconfigured for

polyolefins is the one-piece vertically adjustable cooling ring. According to the manufacturer, the same blow-up ratios can be achieved with this ring as with conventional twin-lip cooling rings where-

by output can be increased markedly.

The company presented additional products from its portfolio at an in-house fair in Lengerich. Besides 3- to 7-layer blown-film lines, they also

demonstrated a water-cooled upside-down water quenching blown film line. This line makes it possible to manufacture, e.g., highly transparent PP films capable of replacing PVC films.

Following its merger, **Reifenhäuser Kiefel Extrusion GmbH**, Troisdorf, Germany, exhibited a blown-film line combining the best components of both line manufacturers. Specifically, the line (**Fig. 2**) is equipped with low-temperature extruders which, in addition to polyolefins, can bond barrier raw materials such as EVOH, PA and PETG.

Thanks to flexibly useable extruders, polyolefin multilayer-films can also be produced on it. Alone in its class at the fair was the collapsing module with several separate drives presented by Reifenhäuser Kiefel Extrusion. It enables different angles to be set when the film is folded. This solution compensates variations in film speed perpendicular to the direction of take-off. Remarkably enough, the bubble then remains extremely stable, thus eliminating the need to trim the edges. An unusual item in the line is a cutting device whose holder is made from microporous material that allows air to flow through it, thereby preventing sticky films from sticking and marking in production.

Hosakawa Alpine AG, Augsburg, Germany, is also picking up on the trend toward polyolefin films. It exhibited a 5-layer blown-film line which can be



Fig. 1. With its new cooling ring, the new VAREX 5-layer blown-film line configured for polyolefins achieves outputs in excess of 1,000 kg/h

(photo: W&H)

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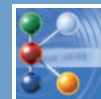


Fig. 2. Nine-layer blow head of the new generation of Evolution lines

(photo: Reifenhäuser Kiefel Extrusion)

used to produce composites with better mechanical properties than conventional 3-layer films as well as films with barrier layers of only 1 μm . The line's high flexibility is enabled by a new generation of extruders capable of bonding barrier materials such as PA and EVOH in addition to polyolefins.

Unprecedented is the in-line stretching process presented by Hosakawa Alpine for blown-film production. This innovative approach is special because it compensates for the necking that takes place when films are stretched. Taking the zig-zag take-off system as it turns into consideration, film profile is controlled by the thickness adjustment on the cooling ring. After stretching, the thickness profile is very uniform across the width of the film (Fig. 3), and only very little edge trimming is required when the film is applied. In addition to films with improved barrier effect and better mechanical properties, examples for application include heavy duty bags where stretching can realize significant material savings per bag.

All the companies in the **Kuhne Group**, St. Augustin, Germany, were represented at a single booth at this year's fair. Instead of the latest blown film lines, visitors were introduced to the wide spectrum of different film products that can be

produced on lines by the Kuhne Group. To observe their lines in operation, Kuhne invited people to an in-house fair taking place simultaneously in St. Augustin. A 3-layer blown film line was demonstrated there by Kuhne GmbH. The essential innovation of this line is its cooling ring developed in cooperation with **Octagon Process Technology GmbH**, Würzburg, Germany. In combination with an internal bubble cooling system, it enables most composite films to be processed in the long-neck

operating mode. Kuhne claims this increases dart-drop and tensile strength by as much as 40 %. **Kuhne Anlagenbau GmbH** demonstrated a triple-bubble blown-film line on which 11-layer biaxially stretched composite films can be produced. The company claims its line can be used to produce composite films with sufficient barrier effect to replace, e.g., aluminum composite laminates for packaging coffee.

Line Retrofitting

In addition to novelties among the complete lines, innovative solutions were presented for retrofitting existing blown film lines.

Plast-Control GmbH, Remscheid, Germany, supplies a central vacuum system with dust deposition as a retrofitting solution for the materials supply in an entire production hall. A pipe identification system checks with formula management in the control whether the correct materials supply line is connected to the proper machine.

As for cooling rings, retrofit solutions are being offered as an alternative to twin-lip cooling

rings. **Plast-Control** claims its new dual-lip cooling ring can increase output by as much as 40 %. The long-neck operating mode enabled by this cooling ring also leads to an improvement in film properties. The cooling ring is equipped with an additional paraffin extractor as well as plastic lips to lengthen the interval between cleanings.

Kdesign GmbH, Königswinter, Germany, is also offering paraffin extraction integrated in the calibration basket in order to lengthen the cleaning intervals of blown-film lines. Since 2009, Kdesign has been offering a counter-current cooling ring whose cooling power is clearly superior to that of conventional twin-lip cooling rings.

Flat Film for Packaging and More

The trend of recent years to using polyethylene terephthalate (PET) as a material continues in the field of flat films. The reason is this plastic's excellent combination of properties together with a low price. PET's good recycling properties make the material very attractive both ecologically as well as economically. Energy efficiency →

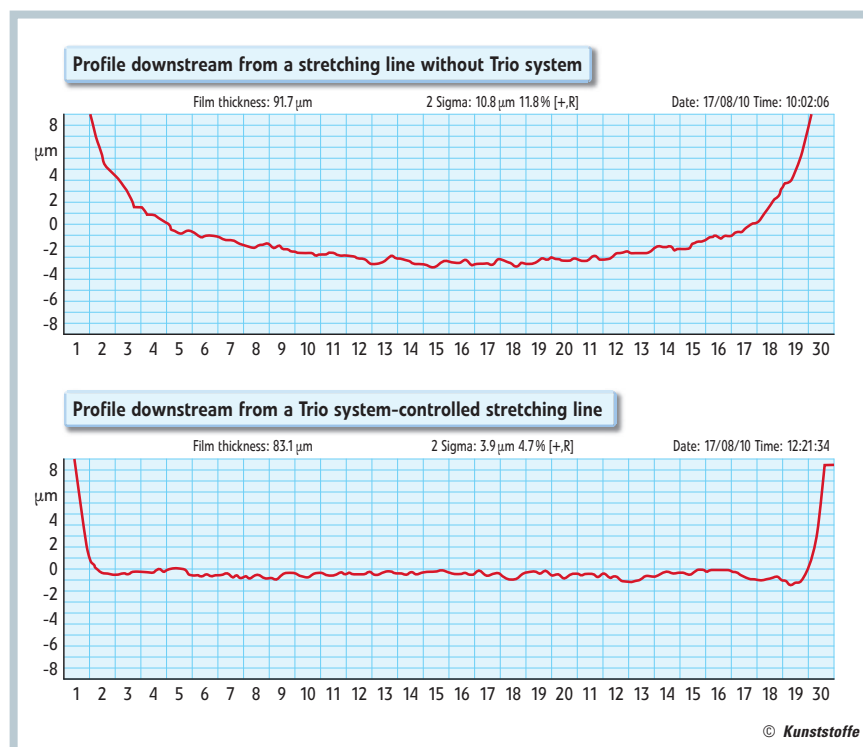


Fig. 3. A film thickness profile after stretching with and without profile control integrated in the cooling ring
(source: Hosakawa Alpine AG)



Fig. 4. Dish thermoformed from a coextruded PET/PE composite for food packaging with a highly transparent nanolayer cover film – both films being produced on the Filmex (photo: W&H)

and sustainability have been the goal of activity in this sector for many years. The focus has been on minimizing raw material consumption requirements and making lines more efficient. Ever thinner film layers are the goal, and so-called fast runners are a standard item in the product portfolios of some line manufacturers. Moreover, applications appear to be expanding. Some line builders are offering concepts to serve the requirements of high-tech industrial branches such as informatics and solar technology.

Windmüller & Hölscher KG (W&H), Lengerich, Germany, is picking up on these trends. Its cast film lines provide the technology for the direct production of thermoforming sheet by the packaging sector. The company claims that PET/PE composites or high-barrier films made of PET/PA/EVOH can be produced that are capable of being directly thermoformed. This permits a lean production by eliminating additional steps for further processing, such as PET stretching and consequent laminating to PE. A PET/PE dish shown in **Figure 4** produced by this method was exhibited at the fair. During daily demonstrations at its pilot plant, W&H demonstrated the production of highly transparent 17-layer nanolayer PA and PE cover films. The Lengerich company sees considerable potential in this relatively new nanolayer technology. The high number of layers enables synergy effects resulting in increased barrier effect, stiffness and thermoformability. This approach enables further “downgauging”.

Reifenhäuser GmbH & Co. KG Maschinenfabrik, Troisdorf, Germany, is also serving market requirements and offering complete production lines for processing PET. The extruders of

coextrusion lines are configured in modules for fulfilling customer wishes. Options include single and twin-screw extruders. The latter (**Fig. 5**) are especially well suited for processing PET and recycled PET: The twin-screw extruder can be equipped with a degassing module that eliminates the need to pre-dry PET granulate and PET bottle flakes, thus saving a considerable amount of energy in production. 100 % recyclates can then be processed trouble free at maximum throughputs of 450 to 2,000 kg/h. Filler materials can be integrated via side-feeders. These in turn enable high doses (up to 60 %) of additive materials such as talc and chalk. Such additivizing is applied for thick thermoform-

station then follows the slot die. In the vacuum form station, a fleece can also be laminated to one or both sides. Such membrane films are used, e.g. for green roofs, sports grounds or floor coverings.

Gneuss Kunststofftechnik GmbH, Bad Oeyenhausen, Germany, is also pursuing direct recycling for recyclates with its processing machines. These systems feature such high degassing and decontamination power that they have been certified by the U.S. Food and Drug Administration for post-consumer waste. New in their portfolio are complete lines (**Fig. 6**) that can be fitted with a cutter-feeder unit from **Next Generation Recyclingmaschinen GmbH** (NGR), Marchtrenk, Austria. This eliminates the need to shred



Fig. 5. Reitruder RZE with concurrent twin-screws and degassing unit for the direct processing of recycled PET (photo: Reifenhäuser)

ing packaging, e.g., from PP or PS. The additives are cheaper than the plastic, thereby enabling savings in materials costs.

The **Kuhne Group** demonstrated its lines at a simultaneous in-house fair. They offer PET direct extrusion lines with throughputs ranging from 1,000 to 2,500 kg/h. Kuhne's extruder is also a twin-screw design and capable of integrated degassing for 100 % PET flakes. In cooperation with the Norwegian company **Oldroyd AS** of Krageo Naeringspark, Kuhne also supplies turnkey lines for producing dimpled sheet. HDPE or PP dimpled sheet are produced at mass throughputs of 1,300 kg/h and in widths up to 4,500 mm. A special form

the waste before recycling. The lines shown at the fair are capable of 450 to 650 kg/h mass throughputs.

PET direct extrusion is also currently offered by **Battenfeld-Cincinnati Extrusion Holding GmbH**, Bad Oeyenhausen, Germany. Following the introduction of their single screw extruder concept with a planetary spindle section at the K2007, the company has expanded its line of machines and is now offering three models with mid-range outputs of 600 to 1,200 kg/h. Battenfeld-Cincinnati also sees top potential in the area of fast runners (**Fig. 7**). Depending on the material used, outputs can be achieved between 1,500 kg/h for PP and 2,000 kg/h for PS. These compact machines fea-



Fig. 6. Complete line with cutter-feeder unit for the direct recycling of PET fibers or film wastes (photo: Gneuss)

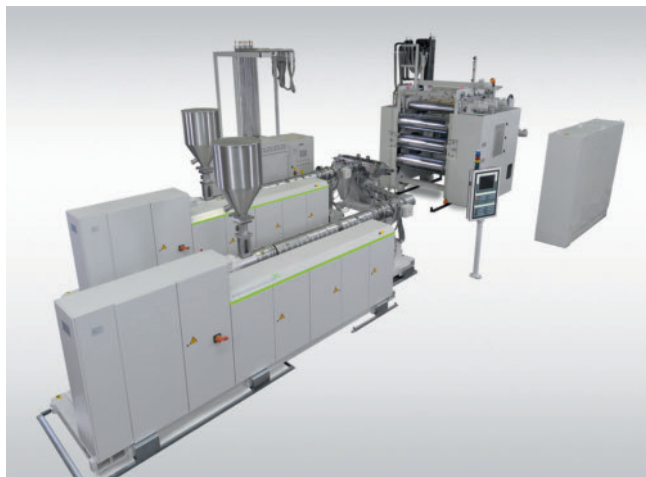
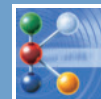


Fig. 7. Extrusion line with fastrunner and corresponding polishing unit

(photo: Battenfeld-Cincinnati)

ture gentle processing and rapid materials change.

As one of a very few machine manufacturers, **SML Maschinengesellschaft mbH**, Lenzing, Austria, exhibited a running cast film line on which they produced a 3-layer PE stretch film. This line is equipped with a 90 mm fast runner whose high efficiency enables an operating mode with a low energy requirement. For the first time, SML is using infrared heaters to heat the extruder cylinder. According to SML, this approach heats the cylinder more efficiently, since cooling and heating can be done in rapid closed loop control. The line features very compact configuration (140 m²) and approx. 1,200 kg/h production output.

Breyer GmbH, Singen, Germany, takes low start-up times



Fig. 8. These single screw extruders combine high quality with their new design (photo: Breyer)

very seriously. Their newly developed automatic die aims at this and regulates itself once the process has been started, thus eliminating manual regulation. Instead, this automation enables a shortened start-up time of ap-

prox. 15 min, thereby limiting the amount of scrap. The company's extruder portfolio includes newly designed single screw extruders (**Fig. 8**) that can be equipped for degassing. Specially adapted technology enables the production of nearly shrink-free EVA films. These films are required for encapsulating solar panels and, in conventional lines, can only be produced at low line speeds around 5 m/min. For this reason, Breyer has developed a system for producing EVA solar films and other sticky materials. The company claims this new process

new system components and improved processing technology improves the processing of very thin films. Meanwhile, 7 µm PET-BO films can now be handled and processed. In order to eliminate working steps (lamination), the Siegsdorf company has concentrated on coextrusion products which permit the integration of barrier layers. The company supplies complete lines for this on which composite films can be produced and which permit direct stretching with Brückner know-how. Brückner's machines and film concepts are positioning it in the innovative industrial fields of solar panels, battery separator films and LCD displays.

Conclusion

Line construction is presenting a widely varied spectrum of machines for specialty and bulk products whose innovativeness is reflected not only in new large-scale solutions, but in many sophisticated detail solutions, as well. Development costs for the multitude of innovations have been honored by well-filled order books.

In summary, the trend observable among blown and cast film line manufacturers is toward offering a combination of machines with innovative solutions for multi-layer films. ■

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