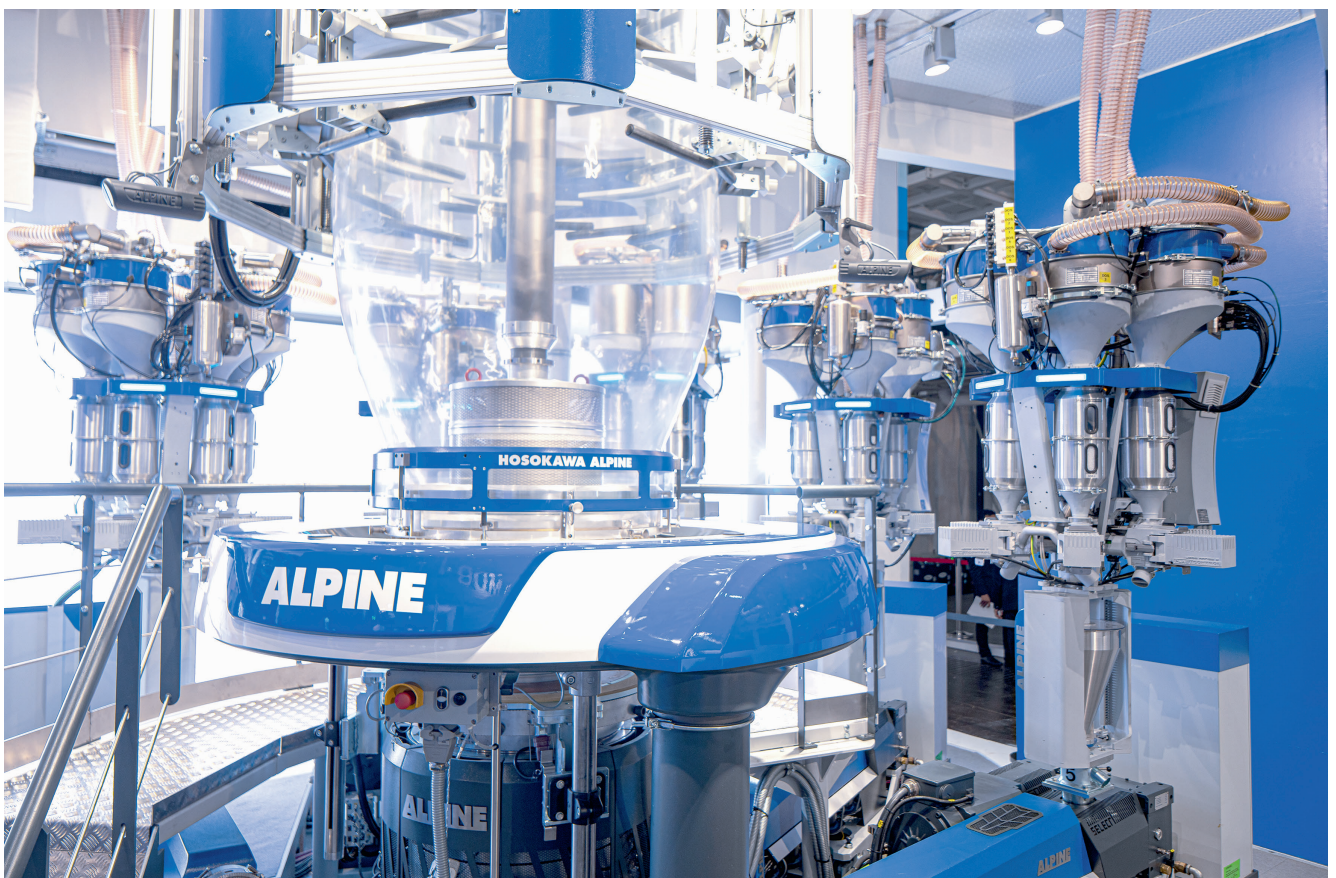


When Less Is More

Blown Film and Flat Sheet Film Extrusion Trend Report

In the interest of sustainability, film extrusion plants have to process recycled materials and also produce recyclable products. Monomaterial products and a plant layout optimized for the products are the current trends. A multilayer structure as such does not pose a problem for recycling as long as all layers are made from the same class of plastic. Digitization continues to be an important driving force as digital tools contribute to solving the problems that need to be overcome.



Hosokawa Alpine produces blown film systems for monolayer to 11-layer production. View of the heart – the tube forming zone – of a 5-layer system

© Hosokawa Alpine

After two turbulent years, film system manufacturers are happy to see positive economic development. **Kunststoffe international** describes the current mood in the industry based on interviews with leading companies.

Ulrich Reifenhäuser, CSO of the Reifenhäuser Group: "After initial uncertainty due to the coronavirus pandemic, developments over the last 15 months have been very positive. The demand for

breathing protection fleece led to a rush of orders in the nonwoven fabric segment and the film segment saw increasing growth as well. Here the demand for packaging – especially for foodstuffs, hygiene products and medical devices – generally increased due to the pandemic. Hygiene awareness has increased around the world and plastic films provide effective protection against the spread of pathogens in many areas."

Michael Baumeister, COO Technology & Logistics at Brückner Maschinenbau GmbH & Co. KG, describes the company's business development with concrete figures: "In terms of incoming orders, the past financial year was the second-most successful in the company's history. The outlook for the coming years is positive as well: the order backlog extends far into 2023.

Dr. Holger Niemeier, Head of Film Technology and Management Board member

Dr. Holger Niemeier,
Hosokawa Alpine
AG: "The challenges
of a functioning
circular economy for
flexible packaging
can only be over-
come by working
with all partners
along the value
chain."

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Topics that Gained Importance in Recent Years

A look back reveals trends that define the topics R&D departments are working on today. Sustainability is the number one issue here. "Efficiency was a major concern in the past. Cooling was also a focal point for a long time in order to boost productivity," Niemeier says. "Monomaterial solutions are playing an increasing role and demand has gone up considerably in this sector," the member of the Alpine Management Board continues.

Reifenhäuser views sustainability as an opportunity even as public pressure on plastics increases. Ulrich Reifenhäuser: "We don't see the sustainability transformation as a threat, but are helping our customers view the higher requirements regarding recyclable products, the proportion of recycled materials, and biodegradable plastic products calmly, to gain speed, and to utilize sustainability as an opportunity for economic success."

Lennart Ederleh, W&H, believes that openness in terms of data exchange »

at Hosokawa Alpine AG, also confirms the positive trend: "Alpine is seeing high volumes of incoming orders from nearly all markets and expects a positive financial result for 2021."

The order situation at Windmüller & Hölscher (W&H) is just as good. Dr. Lennart Ederleh, Technical Sales Director Extrusion: "Diversification with the three divisions of extrusion, processing, and printing was particularly advantageous

for W&H during the coronavirus pandemic. With numerous international service centers and digital solutions, customers abroad could be served even during the lockdown. W&H is a family business with more than 150 years of family history, which also boosted confidence in the market. The group generated EUR 928 million of sales in 2020, and ongoing positive development is expected."

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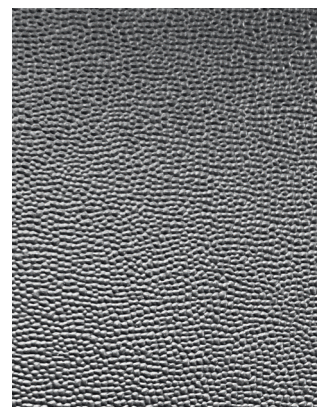
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and cooperation is another important point: "In our world, everyone is concerned about their process stage and has optimized that. When discussing the circular economy today, the horizon has to be broadened, looking beyond company boundaries as well. A global rather than just a local optimum needs to be achieved. No matter who develops what solution, openness for the exchange of data is essential. Here it is important to not merely send data back and forth, creating a mountain of data. Clever interpretation of these data along the entire value chain is the key. This is exactly where our Ruby platform comes in. This transparency also leads to traceability, for example, to verify the recycled material content of films."

Current Product Highlights

Alpine's product range includes blown film systems from monolayer to 11-layer production (**Title figure**), with optional monoaxial stretching units. The MDO was optimized for even better flatness

this year. Customer service also includes services such as project planning. A high-performance AW series film winder is new to the product range. It supports roll changes in less than 45 seconds and has numerous handy features for high-quality roll production and process reliability.

In the blown film segment, Reifenhäuser is introducing the patented EVO Ultra Stretch technology to manufacture monomaterial composites (full PE films) for flexible packaging (**Fig. 1**). The film is fully recyclable through the exclusive use of PE. With a stretch rate of up to 10 times, the Ultra Stretch stretching unit improves the mechanical properties of the PE film as a straightforward PET replacement. According to the manufacturer, the position of the stretching unit directly in the outfeed of the blown film system makes the process stable and efficient. The film, still warm from extrusion, is stretched without being heated again.

Monoaxial, biaxial, and simultaneous film stretching technology is Brückner's core competency. The manufacturer of flat sheet film systems developed the continuous Lisim simultaneous stretching process between 1993 and 1996, which uses linear motors to stretch the film in two directions in one operation (**Fig. 2**). This established technology is highly reliable and produces very good film properties.

A product highlight at W&H is the Optimex II, a blown film system for three to five layers, now available with a larger working width of up to 2.60m. The Filmatic S II O film winder is offered as a complement (**Fig. 3**). This contact winder in a modular design was developed with a focus on optimal roll quality. Numerous technical developments were also realized and

great emphasis was placed on intuitive user guidance.

Support for Rapid Material Changeovers

Reifenhäuser focuses on the Mirex PET/PLA sheet system in the flat sheet film segment. When required, this system is prepared for fast and easy conversion to PLA processing. Due to its physical and mechanical properties, the bio-based material PLA is well suited as a sustainable replacement for PET-based thermoplastics. The REltruder twin screw extruder technology supports direct extrusion without pre-drying and the processing high proportions of additives and fillers, among other things. It is FDA-approved for use in the food industry.

Brückner is also counting on flexible systems for the future, supporting a change of materials between PE and PP. Full plant utilization by the customer without long changeover times is the goal.

Flexibility and therefore the customer's needs take center stage at W&H as well. "W&H works with customers to develop sensible systems to meet customer needs and market requirements. Further development and market changes are taken into account and incorporated in planning from the outset. This ensures maximum productivity and future viability," says Lennard Ederleh.

Digital Platforms Are in Demand

Aside from digitization, sustainability is a continuing mega-trend. There is little evidence of genuine networking between systems – so they interact with each other – in the extrusion sector to date. Continuous data flows from ERP systems to machines and processes to the product are therefore the next step.

Reifenhäuser covers a broad range of digitization solutions for modern production plants – from plant control to fully automated assistance systems and remote service to full integration with ERP systems.

Brückner is working on digitization in many areas of the company as well. Ma-

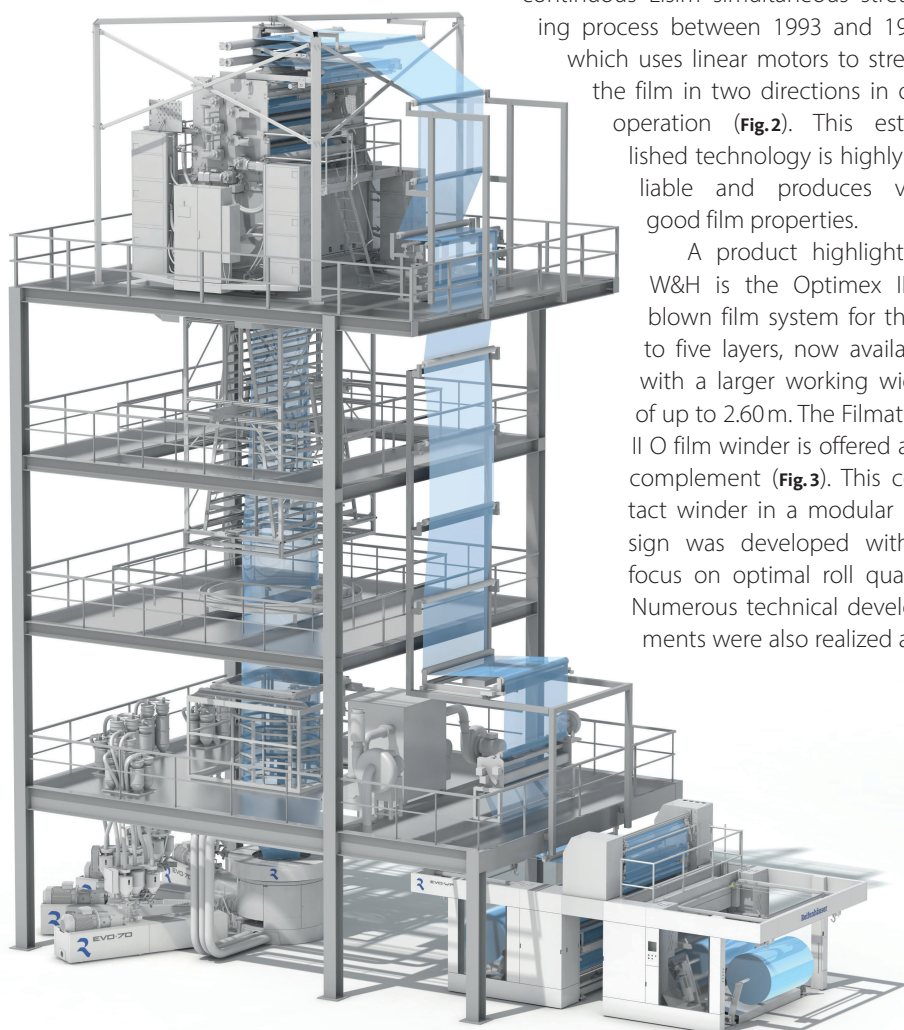


Fig. 1. In the Reifenhäuser EVO Ultra Stretch line, the PET layer is replaced by stretched PE. The stretching unit is positioned directly in the outfeed © Reifenhäuser



Ulrich Reifenhäuser:
"Especially for bulk products, less is often more when it comes to the plant layout. Options that do not add value for these products merely increase the investment cost and make the plant more complex to operate." © Reifenhäuser

R-Cycle

Recyclable formulations, the use of global identification numbers, standardized data formats, and the establishment of a stable server structure: R-Cycle establishes the foundation for a closed circular economy.

Development efforts for the traceability of film formulations have been underway for about two and a half years. Initial, interim results have already been presented to the industry audience at the K2019 plastics trade fair – with a positive response and numerous suggestions for new pilot projects. Major progress has been made since then. Today R-Cycle already has the ability to digitally record all information relevant for recycling during the production of packaging films, and to deliver the collected information. All relevant parameters are automatically recorded in the database through an IoT gateway. Packaging is clearly marked and serialized with globally valid identification numbers.

In the summer of 2021, the project won the German award for sustainability projects. The initiative placed first in the packaging category.

The following partners are involved in R-Cycle: Arburg, Brückner Maschinenbau, Comexi, EECC European EPC Competence Center, Erema Group, GS 1 Germany, Institute for Plastics Processing (IKV), Kampf Jagenberg Group, Kautex Maschinenbau, Multivac, ProData, Reifenhäuser, Steinert

» www.r-cycle.org

chine Condition Monitoring (MCM), the growing number of assistance systems for plant control, and Easy Operation (EOP) are examples of digital features for film stretching systems offered by Brückner. The latter is part of the "Brückner One" solution: a digital platform that supports all needs of the film stretching system during the life cycle, including its operation – all from one source. The digital service platform comes standard with all new systems and can be retrofitted in older plants.

W&H's answers to the digital platform are Ruby Go and Ruby Gain. These systems link inline and offline process data, ensuring the monitoring of all production parameters in real time.

Composite Film versus Recyclability

Are multilayer films still an issue in the future – or will the trend reverse as recyclability gains importance? The manufacturers that were surveyed have clear answers to this question. Holger Niemeier of Alpine: "A multilayer structure as such

does not pose a problem for recycling. What matters is whether different classes of plastics are used. In fact, multiple layers could make it possible to obtain properties that are otherwise only attainable by combining different types of plastics. Thus a multilayer structure does not conflict with sustainability."

Ulrich Reifenhäuser has a similar view: "Multilayer films do not automatically mean that recyclability is not given. What is important is that the materials used are compatible in terms of recycling, or ideally that only one type of plastic is used. Multilayer full PE blown films are a good example of a fully recyclable mono-material composite."

Can a high product quality be maintained when recycled materials are used? According to Alpine, this is possible in many applications even though recycled materials is not being used for all of them today. In the end, the quality of the recycled material is decisive. "However, the availability of high quality recycled materials is currently still very low for certain applications," Reifenhäuser adds. »

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Michael Baumeister, Brückner Maschinenbau: "Monomaterials define the trend. With inline coating, a very good barrier can be realized, even in mono-structures."

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What Matters in Systems Engineering

Film extrusion is mass production: what factors ensure the future efficiency of systems? "A plant layout tailored to the product is the most important factor. Especially for bulk products, such as metalizable film, less is often more when it comes to the plant layout," Ulrich Reifenhäuser believes. "Options that do not add value for these products merely increase the investment cost and make the plant more complex to operate."

At Brückner, the system width and speed are key factors in the film stretch technology segment. "This not only applies to packaging film systems, which are already very fast today, but also to specialized systems. Efforts are underway to increase both values here in order to achieve a higher plant efficiency. R&D is also focusing on energy and raw material efficiency," Baumeister explains.

Alpine is working on a second cooling ring for improved performance, among other things. "Simplified system operation, where the operator can see everything at a glance, is one of the trends," says Niemeier.

Lennart Ederleh agrees: "Processes are becoming more complex and finding well trained operators keeps getting more difficult. Efforts are therefore being made to simplify operation as far as possible, making complicated processes manageable for the customer."

What Will Gain Importance in the Future

The circular economy is the overriding trend. Plastic films are high-performance products that, from an integrated per-

spective, have great sustainability potential in the packaging sector – especially regarding climate protection. Due to their low weight compared to other materials, such as glass or metal, they reduce CO₂ emissions during the transport of goods. The energy demand for recycling is lower as well. The problem, however, is that the high quality recycling of plastic waste is not yet sufficiently established today.

Ulrich Reifenhäuser: "Two key basic prerequisites have to be met in order to make this possible: fully recyclable packaging and highly developed recycling processes. Various recyclable packaging solutions already exist for the first prerequisite. To meet the second prerequisite, today's waste streams need to be examined. Even fully recyclable packaging is frequently not sorted precisely enough for high-quality recycling. This is where the two mega-trends of sustainability and digitization meet. What is known as a

digital product passport can lay the foundation for a highly developed recycling process by automatically recording the properties relevant for recycling during the production of plastic packaging. Precise information is thereby passed along the value chain and can be made accessible with special markings on the packaging, such as digital watermarks or QR codes. Based on this additional information, waste sorting plants can identify recyclable packaging and sort it into recycling-friendly pure fractions. The combination of fully recyclable packaging and life cycle data from the digital product passport for precise waste management is the key to obtaining recycled materials of high quality, closing the circle, and transforming the value chain into a value cycle." Under the R-Cycle initiative, Reifenhäuser with other partners is committed to the development of a standard for digital product passports (see Box p. 27).

Michael Baumeister in response to the question of what the most important future issues will be: "Plastics and the environment! Brückner is convinced that the future still belongs to plastic, provided it is used sustainably and reused. As part of a circular economy, the indisputable advantages of plastic can definitely be combined effectively with the sustainability objectives of a modern society. Brückner is working intensively on the production of films with the highest possible degree of recyclability and the lowest possible use of resources on the machines. This includes cooperation in various consortiums with partners along

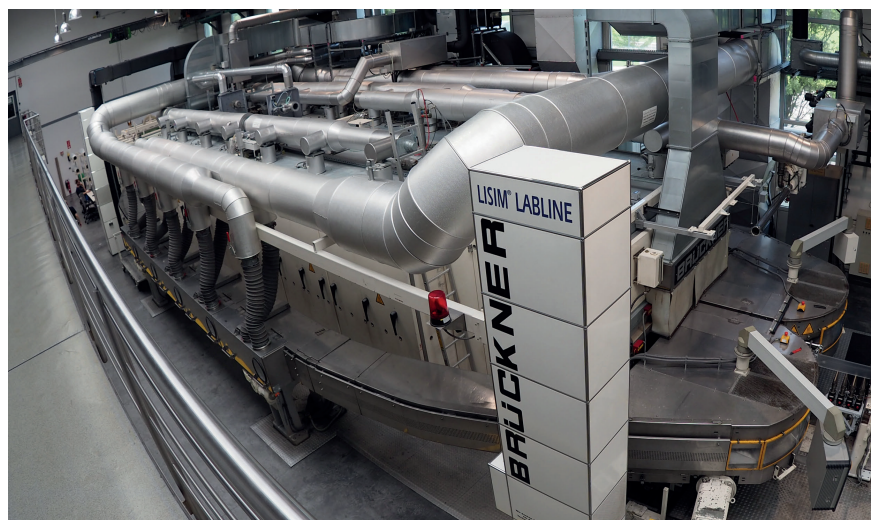


Fig. 2. Brückner is adept in the biaxial stretching of films. In the Lisim simultaneous stretching process, linear motors stretch the film in two directions in one operation © Hanser/Schröder



Dr. Lennart Ederleh, Technical Sales Director Extrusion: "Openness to the exchange of data and looking beyond company boundaries are essential" © W & H

the entire value chain, from the raw material producer to the brand owner. The R-Cycle (see Box p.27) and PrintCYC initiatives are examples".

Holger Niemeier considers cooperation very important for the future: "The challenges of a functioning circular economy for flexible packaging can only be overcome by working with all partners along the value chain. On the one hand, our blown film systems have to produce recyclable films, and on the other hand, they must be capable of optimally processing recycled materials. Here the interplay of the entire industry is the key challenge. Film properties need to be optimized while the use of materials and energy is minimized."

The Race to the First Full PE Film with Barrier Function

Will a full PE film also be able to provide a barrier function in the future? Everyone is working on this today. Which developments are presented by the manufacturers at next year's K trade fair will be exciting.

Lennart Ederleh, W&H: "There will be developments that make homogeneous composites with a certain barrier function possible. Homogeneous but not made of a single polymer; rather, homogeneous with about five percent of permissible extraneous material, which currently seems to be the trend. A lot of development work remains in this field. The

goal is to obtain barrier effects with a low proportion of extraneous material, making it possible to package foodstuffs that require an oxygen barrier."

Brückner is conducting research in the same direction: "Monomaterials define the trend. With inline coating, a very good barrier can be realized, even in mono-structures," Baumeister says.

Conclusion

Material performance was a defining topic in the past. This remains fundamentally unchanged, only with a different focus. Now what counts is the performance of recycled materials that are not yet available in sufficient quantity and quality or at a price that makes processing economical.

Numerous raw material, system, and packaging manufacturers are cooperating closely to make the industry fit for the future. New material combinations, recyclable products, and energy-efficient systems are being researched in a whole series of development projects. The R-Cycle project is just one example.

According to the motto "less is more", machine manufacturers are asked to supply systems that are easy to operate and process films made of fewer different material classes. With outstanding properties, naturally. ■

Susanne Schröder, editor

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Service

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Fig. 3. The Filmatic II O contact winder in modular design was developed with a focus on optimal roll quality © W & H