Integrated Process Chains for Packaging Films

From Resin through Extrusion to Final Product

Every three years, experts are invited to Windmöller & Hölscher KG's (W&H) in-house 'Expo' exhibition in the parent factory in Lengerich, Germany. On June 10th and 11th this year, more than one thousand visitors from 60 countries came to inform themselves about the comprehensive and impressive product range for the production of flexible packaging.

More than 1,000 international guests accepted the invitation to the in-house Expo 2015 in Lengerich (figures: W&H)

With one cast film and five blown film lines, the Extrusion business unit showed a representative cross-section of current film manufacturing trends. An Aquarex machine produced asymmetric, water-cooled barrier films with 7 layers for thermoform applications. Visitors were able to convince themselves of the performance of Varex II machines, three of which were demonstrated in entirely different configurations with examples of cost-saving potential and product innovations. Previously only available as a 3-layer system, the Optimex celebrated a premiere: As the first 5-layer system of this series, it produced 5-layer stretch hood films, thereby proving that these perform better and cost less than conventional film structures.

The Filmex cast film line demonstrated the production of thin, high-strength stretch film ("taut film") for economic and reliable cargo securing.

Next to the extrusion presentation, the products of the Printing business unit, with one gravure and three flexo printing presses, also attracted the visitors' attention.

In addition, the new Packaging 4.0 concept was addressed. Hereby, data-specific networked process chains are combined with powerful sensor technology and highly specialized automation modules for flexible production of packaging materials. These are featured by intuitive operation as well as intelligent response to changes in the process parameters. The Expo also demonstrated the new possibilities that can be opened by the 4th Industrial Revolution with networked production systems and the data-specific pervasion of facilities for packaging material manufacturing.

Fast Material Change

The first Varex II line focused on the subject of raw material change in laminating film production with the help of automation modules and flushing programs (**Fig. 1**). Where an operator previously needed about half an hour for the manual changeover of a 3-layer system, W&H has now succeeded in reducing this changeover time to two minutes, thanks to automation. This was made possible by combining an intelligent control algorithm with the automatic pneumatic cleaning of gravimetric and suction feeder systems. Now, the machine operator must only move the suction lance from one raw material container to the other.

During the demonstration, Expo visitors were able to witness the reduction in

Fig. 1. Operating unit of a Varex II with intelligent control algorithm

Fig. 2. The Optimex, previously only available as a 3-layer system, is now also offered as a 5-layer system

the time required for changeover. The procedure was demonstrated on a 3-layer system with 280 mm nozzle and a working width of 2,200 mm.

Down-Gauging by Inline Stretching

Showcased was a 3-layer Varex II blown film bline with an inline machine-direction orientation (MDO) stretching unit, and integral Optifil P-MDO thickness profile control. By means of the MDO technology it is possible to manufacture plastic films with a unique range of properties and simultaneous reduction of film thickness. On demonstration was the production of a particularly thin, permeable diaper backsheet film weighing only 12 g/m^2 by means of the blown film process with inline longitudinal stretching.

Today, films for this application are preferably produced by the cast film process, with basis weights of 14...17 g/m^2. "But the trend is quite clearly towards blown film" is the conviction of Lennart Ederleh, head of customer support for extrusion plants. "Blown films will replace cast films in this field, firstly because other raw materials are used, and secondly, because a process-related biaxial orientation of the molecules is created. Both aspects improve the film's mechanical properties and thereby its down-gauging potential."

With the MDO process, the films (blown or cast) are stretched continuously in machine direction. Due to this stretching process, the film's thickness is reduced, and also its morphology is modified in a targeted manner. Permeability is achieved by stretching mineral-filled films. During the stretching process, the polymer matrix becomes detached from the filler material particles, whereby a fine network of micropores is created. These micropores permit gases to pass through the film, but are impervious to liquids.

However, stretching in the machine's running direction not only reduces film thickness: The film's width is also reduced due to neck-in. This neck-in effect results in a cross-film thickness profile with pronounced thicker edges. Therefore, to ensure problem-free processing of the stretched film in the subsequent production steps, these thicker edges must be removed by trimming before the film reaches the winder. Because each of the edge trims can be up to 150 mm wide, the machine's net yield is reduced accordingly. In order to reduce the amount of edge trim and thereby save material, the demonstration line was fitted with the integral Optifil P-MDO thickness profile control unit, which ensures a constant thickness across the width of the stretched film, so that the amount of edge trims is up to 50 % less.

This exhibit also illustrated the Packaging 4.0 concept particularly well, as the permeable diaper backsheet produced on the Varex II was subsequently printed on a Vistaflex flexo machine.

Resealable Film Lids

Resealable packaging, e. g. for sausage or cheese, is characteristic for changing consumer lifestyles. During production of this packaging type, it is the need for resealability in particular, which places very high demands on the film that is used as lidding material. Pressure-sensitive adhesives (PSA) have been used for this purpose since a long time, but their extremely high adhesive strength makes them very difficult to process.

"We have now succeeded", reports Dr. Falco Paepenmüller, head of the Extrusion business unit, "in finding a possibility how this material – in combination with a PA-EVOH-PA barrier – can be processed easily into a high-grade 9-layer high barrier film with a PSA hot melt layer for resealable lidding applications." This pioneering development was shown on a Varex II 9-layer system with 2,600 mm working width and a 500 mm nozzle.

5-Layer Film for Stretch Hoods

The Optimex, previously available only as a 3-layer system for extruding a wide »

Networked Technologies under One Roof

During the in-house exhibition Expo 2015, Gerhard Gotzmann spoke with Dr. Jürgen Vutz, CEO and shareholder of W&H, and with managing partner Peter Steinbeck about trends in the film market as well as the company's strategic orientation.

Kunststoffe: *What is the present situation in your markets? Are there any special developments?*

Steinbeck: Generally, the market growth of 4,5 percent for flexible packaging is above average. This formed the basis for our planning. Of course, we also see other tendencies that will impact our product range, as well as regions in which we can increase our growth. Naturally, this involves the fast-growing Asian countries, where we can find new customers and reach a larger market with a wider product range. Competitive advantages are also achieved with innovations and technologies, which results in growth. Not only the present boom for flexible packaging, but also our innovations have helped us to gain a stronger market position.

"Generally, the market growth for flexible packaging is above average."

Dr. Vutz: With the diaper backsheet, for example, we see a clear trend away from cast films towards blown films. Blown films have clear advantages here: To start with, we are able to use thinner films, i.e. to produce films with lower material consumption but with the same properties. In addition, the patented process permits scrap to be reduced by up to 50 percent. All of this results in a highly competitive product, and opens up enormous potentials for improvement.

Kunststoffe: *How did your turnover develop during the past years?*

Steinbeck: Since the crisis in 2008/2009, W&H has enjoyed a continuous upwards trend. Last year, our Group achieved a turnover of some 670 million Euros. This year, we are expecting 700 million, and when we celebrate our 150th anniversary in 2019, we hope to reach the 850 million mark. That is our aim. Of course, this only applies under the condition that the economy remains as favorable as it is at present.

Kunststoffe: *You have invested in new buildings and a logistics center. What are your intentions?*

Dr. Vutz: Our investments were not only in buildings, but also in people. During the past two years, we have created about 200 new jobs – mainly in the service area, in research and development, and also in sales. This is particularly important to ensure that with increasing turnover we continue providing our customers with optimum support. This year, 100 new employees will join us, thereby ensuring that the number of qualified persons in our workforce expands together with our turnover targets.

Regarding the investments in hardware, a major item is the expansion of production capacity. For example, we now have a very modern machine tool inventory, enabling us to produce our high-end components in the corresponding quantity and quality. Moreover, we will also invest in the expansion of our laboratories, i.e. our showrooms, for the purpose of presenting a wider range of machines. Already now, we have the world's largest laboratory for flexible packaging. Also in future, we want to be able to offer our customers the possibility to reproduce any of their processes here, backed by intensive technical support. What's more, we have invested in a new office building, to provide attractive workplaces for our employees. The extension of the logistics center should be completed by the end of the year, and the new building will help us to optimize our logistic processes.

Dr. Jürgen Vutz (left) and Peter Steinbeck count on qualified staff and create attractive workplaces (figure: W&H)

Kunststoffe: *A term coined by your company is "Packaging 4.0". What exactly does it mean to you?*

Dr. Vutz: Here, we are talking about integrated processes, intuitive user interfaces, and intelligent sequences in the entire system. And also in the coming years, we will position our products along this guideline. In future, the subject of data acquisition and processing in the machine will offer even more possibilities. This aspect of Packaging 4.0 involves technology and machines.

The second aspect is that W&H aims to become ideally positioned by means of a comprehensive approach – from raw material through extrusion up to the finished end product. We provide a full range of technology under one roof, which enables us to offer a networked approach, together with expert advice and support for our customers. Ultimately, all of this will lead to efficient and high-quality processes, and thereby result in better profitability for our customers.

range of films in the 3-layer segment, is now also available as a 5-layer system (**Fig. 2**). However, not only the machine had its premiere at the Expo – but also the product, which was manufactured at the in-house exhibition: A film for stretch hoods, which was produced as a 5-layer film for the first time, and proved that it offers higher performance and costs less than conventional film structures.

"5-layer is the new 3-layer", Lennart Ederleh puts it in a nutshell. "I am convinced – and this is backed by the market developments we have observed – that PE products will be produced mainly as 5-layer films in future." These 5-layer films are either thinner than the previous 3-layer films – because the use of higher grade materials permits down-gauging – or film thickness remains the same, but cheaper materials are used. "But regardless of the approach used, the reason is always the same", adds Lennart Ederleh. "Ultimately, the issue is always the reduction of raw material costs, which after all account for more than 80 percent of film production costs."

Apart from the production of packaging, sealing, carrier bag, and laminating films, the Optimex has also been optimized for the production of stretch and shrink films as well as FFS bagging films – and this applies equally for the 3-layer and 5-layer systems. In this way, the Optimex forms a bridge to the W&H's Argon hood stretcher and also to the FFS bagging lines, thereby presenting a good example of the consistency provided by Windmöller & Hölscher's extrusion and processing products in the sense of Packaging 4.0.

"Taut" Stretch Film for Load Securing

Load securing is not only an issue for logistics companies. On the contrary, it is also a central topic for the packaging industry, in particular for stretch film producers. Three years ago, W&H organized a well-attended international symposium dealing with the effects of the newly introduced EU Directive on load securing, and its influence on the stretch film market. At this year's Expo, the company used a Filmex cast film line to demonstrate the production of a particularly thin, high-strength stretch film that is well known in the market as "taut film" (**Fig. 3**).

Fig. 3. The production of a particularly thin, high-strength stretch film was demonstrated on a Filmex cast film line

The term "taut film" stands for a stiff film with limited stretchability, which exhibits very high holding strength and puncture resistance in spite of its small thickness of just 8 µ. "This film permits the implementation of economically very attractive solutions for reliable load securing – in particular with simple shrink wrappers", explains Dr. Torsten Schmitz, head of the Cast Film business unit.

The film was produced on a Filmex cast film line at speeds up to 600 m/min. With this universal machine, W&H makes an important contribution in the manufacture of demanding stretch films. The intelligent design of the machine's components, and especially their interaction in terms of automation results in an outstanding consistency of film properties, which can even be monitored inline. The fully automatic high-speed turret winder Filmatic PS is used for producing optimally wound film rolls. Unique design features such as quadruple winding shaft bearings and perfect web guidance permit high winding speeds and reproducible film roll quality even with the thinnest films.

Industry 4. Leads to Packaging 4.0

The term "Industry 4.0" is omnipresent. It was the dominating topic during the last Hanover Exhibition, and not only there. Trade media purport that the economy is at the threshold of the 4th Industrial Revolution, and the question is being discussed, whether German industry – and medium-sized companies in particular – is at all prepared to meet this challenge. With the motto "Packaging 4.0", Windmöller & Hölscher wishes to express that the company is ready to face this challenge. The Expo was able to show which new possibilities will be offered by the 4th Industrial Revolution in terms of networked production lines and data-specific penetration of manufacturing in the packaging material business.

Due to the worldwide unique product consistency in the fields of extrusion, printing, and processing, and more than any other company, W&H is predestined for the subject of Packaging 4.0. and ready to face the megatrends in their business area while working on solutions for the urgent challenges of increasing raw material prices, limited resources, increasing price pressure, and decreasing qualification levels. ■ *GG*

Service

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