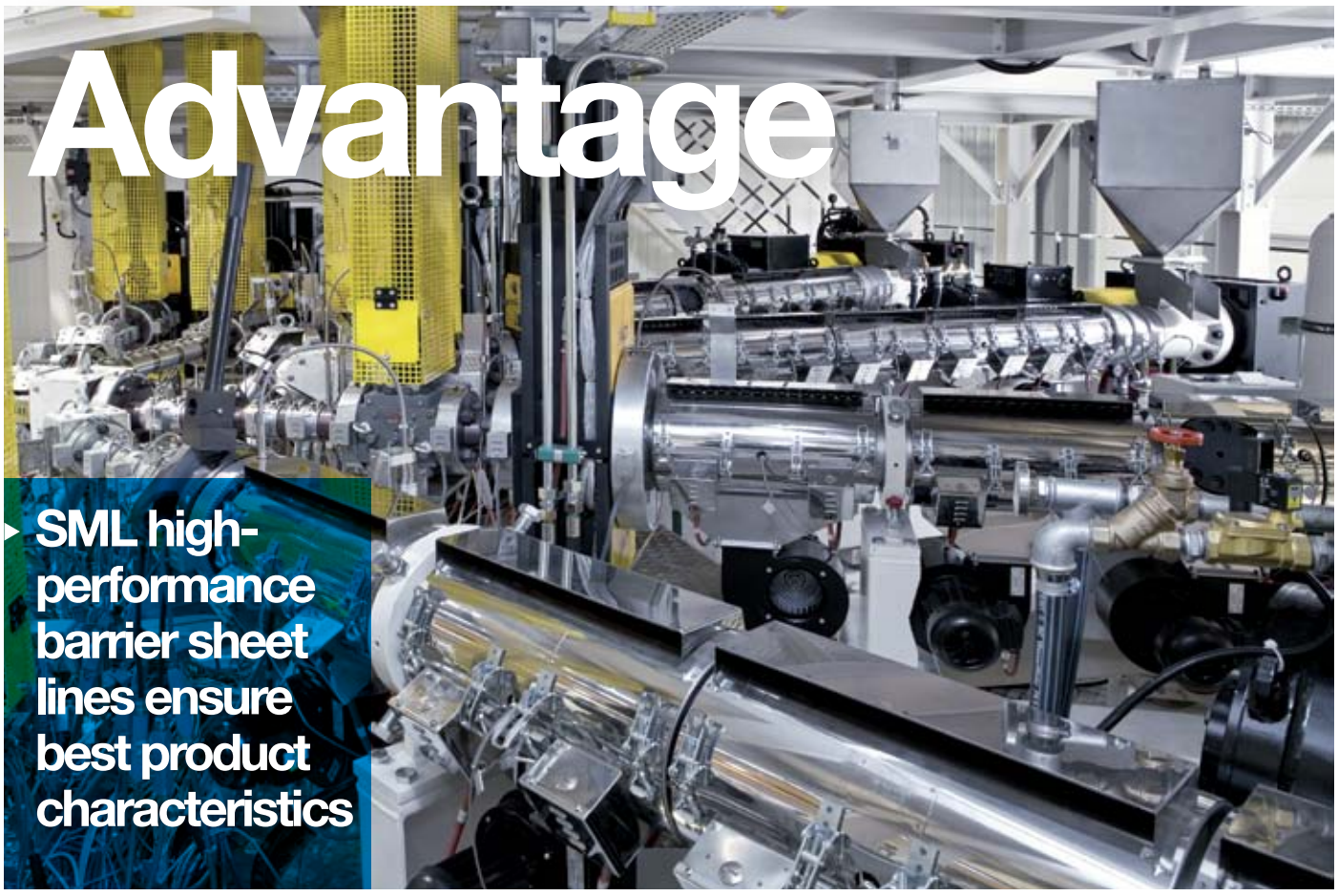
SML TECH REPORT

N°30 / 02-2017



extruder arrangement of a high-performance barrier sheet line

High output PP/EVOH barrier sheet line

Extended shelf life for fruit products or pre-cooked meals demands first class packaging with excellent barrier properties. The aim is to retain the flavour, aroma, colour and freshness of the food. Within this context the employment of a tailor-made EVOH layer in the film structure can form an effective safeguard against undesirable environmental influences and thus ensure long-term freshness. However, the production of top quality barrier layers using EVOH is far from simple.

THE ADVANTAGES OF PP FILMS WITH AN EVOH MIDDLE LAYER

- Outstanding barrier characteristics against gases, water vapour and odours
- High resistance against fats and oils
- Excellent thermoformability and good mechanical properties of the product
- EVOH composites are recyclable and thus avoid enviromental burden

SML HIGH-PERFORMANCE BARRIER SHEET LINES WITH NEW EXTRUDER TECHNOLOGIES

The employment of EVOH creates special demands with regard to melting, which SML barrier sheet lines fulfil through the incorporation of two differing extruder concepts.

The most important process parameter for the extrusion of EVOH barrier films is a low melt temperature, which requires particularly gentle melting in the extruder. SML ensures that this is achieved through the use of special high output / low temperature (HO-LT) extruders, which take the heat-sensitive characteristics of EVOH into consideration. A single HO-LT-55 extruder facilitates EVOH production amounting to as much as 250 kg/h.

In addition, as far as the polyolefine outer and intermediate layers are concerned, SML's **H**igh **S**peed **E**xtruders (HSE) with direct drives are recommended. These make very high production rates possible, as evidenced by PP output of up to 1,500 kg/h from just one HSE-75. Furthermore, both extruder series are notable for their low power consumption per kilogram of material.

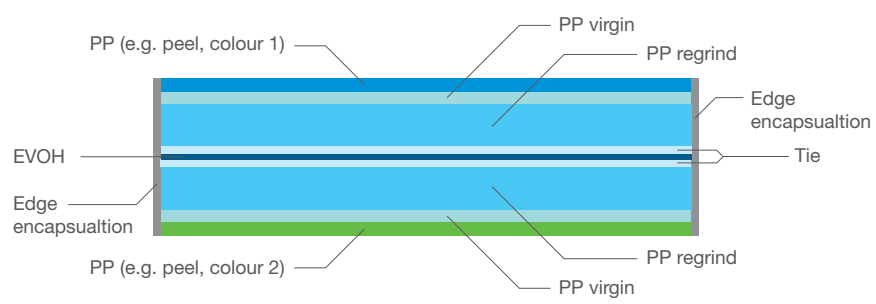
These extruders are operated with SML roll stacks of horizontal design, which possesses up to 9 post-colling rolls to serve raise of throughput. As a consequence, despite unchanged film widths, the latest equipment generation produces high-barrier PP/EVOH/PP sheet at an output of 2,500 kg/h. Accordingly, at this performance level, SML barrier sheet lines are well able to hold their own in international competition.

JOINT RESEARCH WITH THE JOHANNES KEPLER UNIVERSITY

New materials and composites are continually being tested and developed in cooperation with the Institute of Polymer Extrusion and Compounding (IPEC) at the Johannes Kepler University in Linz. In order to keep pace with the steady increase in demands regarding quality and innovation of barrier sheet, an SML high barrier sheet line has been installed at IPEC for continuous research and development. (www.extrusion.jku.at)

PP barrier cup for fruit salad

Typical symmetrical PP barrier film structure



Editorial

Karl Stöger
Managing Director

Dear Reader,

We have been publishing the "Technology Report" twice annually for the past 15 years. Therefore, it was high time that it received a facelift and we are proud to offer you edition no. 30 with a new look.

We hope that the makeover will be to your liking and, equally important, that the articles assembled by our editorial staff will again prove of interest. These include information from our R&D department about a new and improved drum winder, and a recent project involving a high-output, high barrier sheet line.

Other features deal with the burning issues of the fourth industrial revolution and the essential matter of recycling. The former relates to our implementation of the latest digitisation technology in our control systems for even greater extrusion line efficiency, while the latter points to PET as a raw material that is ideally suited to closing the packaging loop.

The ongoing upswing in our industry is remarkable and has resulted in strong demand for high-performance extrusion lines, which has helped SML to grow faster than planned. Therefore, we would like to take this opportunity to thank all those that have contributed to this success and express our gratitude to our customers, whom we have the privilege of serving.

Yours sincerely,

Think big

A new drum winder for large diameter rolls

SML has acquired an excellent reputation in the winding and unwinding technology field. Over the years, customer needs have been addressed through innovative solutions, improvements to existing products and completely new ideas. Accordingly, in order to further optimise the product portfolio, it was decided to redesign the winder employed for laminates, board composites and woven fabrics. This new so-called drum or contact winder, which is based on one of the longest serving products in the SML programme, is suitable for heavy product rolls of up to 4 tons due to the fact that it does not require a turning unit and therefore the critical rotating movement is unnecessary. Via the winding drum, the contact pressure and winding tension are exerted externally onto the roll to be wound, which remains in contact with the winding drum until its very last layer.

ENERGY-SAVING TECHNOLOGY

Unlike on a turret winder, the applied power of the contact winder motor does not have to be raised in accordance with increasing roll diameter. This permits a very considerable reduction in both the installed motor power and related energy consumption. In order to create the maximum flexibility required for the processing of differing materials, the drum winder, which normally works surface driven, can also be equipped with a centre drive as an option.

The new winder series bears the designation W1800 and is designed for roller widths of 1,500 to 3,500mm, a maximum production speed of 500m/min and the handling of roll diameters of up to 1,800mm. Depending on the application, a choice is available for cross cutting using a guillotine or a flying knife. Both versions are equipped with a counter support that is mounted in satellite style on the winding drum for optimised cutting geometry. Consequently, the winder can be utilised for both heavy composites such as aseptic cardboard packaging and reinforced laminates.

The winder W1800 is fitted with an autonomous control system, which facilitates retrofitting into existing lines. All the settings required for winder operation can be predetermined via a touch display and then stored permanently using a recipe management program. In addition, in order to keep the personnel requirement for the winder to a minimum, it is equipped with an automatic roll and winding shaft handling system. Following fully automatic splicing, the finished product roll is carried out of the winder by a movable, hydraulic lifting platform and laid on a table. An extractor then removes the winding shaft, which following subsequent manual core preparation with the aid of a portal robot, is then returned to the winder automatically.

Ready

for digital transmission

The use of the term "industry 4.0" for the 4th Industrial Revolution has given a name to the efforts aimed at the optimisation and flexibilisation of industrial processes by means of comprehensive networking, using local or cloud-based logging of quality-defining parameters from the sensor/actuator level right up to the ERP level.

The "industry 4.0" megatrend thus incorporates technologies, which not only revolutionise the entire automation branch, but also exert a major influence on company information structures.

COMMUNICATION OF THE FUTURE

Even before "industry 4.0" became a hot topic of discussion, SML was already busily working on energy monitoring and overall equipment efficiency (OEE), and for many years has offered scalable process data logging, which plays a significant role in analysis and quality assurance. For almost fifteen years, SML has been employing OPC technology in the human-machine communications sector. Initially, standard DA was used, but now unified architecture (UA), manufacturer-independent protocols are utilised, which represent the communications of the future.

OPC UA with time sensitive networking (TSN) will transform both the horizontal communications level between individual PLC and motion controls, as well as forming a vertical level bridge in the IT world. Consequently, SML systems will demonstrate maximum connectivity to both subsuppliers and specific customer portals.

Such connectivity will also provide the basis for the data management of all the visualisation applications, which form the human-machine interface (HMI) between the operator and the SML system. Modern, web-based technologies facilitate user-specified visualisation content and individualised presentations on differing output devices, in order to furnish both the system operator with an overview of important production parameters and enable quality supervisors to analyse ongoing production.

GEOGRAPHICAL DISTANCES REDUCED TO A VIRTUAL MINIMUM

Should servicing be required, SML systems dispose over a remote management solution, which is safeguarded by virtual private networks (VPN), firewalls and certificate-based connection set-up strategies, and is linked to a central contact point at SML headquarters. This secure remote management system, which is administered solely by SML, offers a range of functions that extends from diagnosis possibilities to program updates and thus reduces the geographical distances separating our customers around the world to a virtual minimum.

At SML, "industry 4.0" constitutes a continuous development process, which by means of the utilisation of established and innovative communications technologies is intended to contribute to the enhancement of the systems used by our customers through improved energy efficiency, use of capacity and availability. Predictive maintenance systems, support and assistance systems in the customer and technical service areas, and algorithms for self-optimisation, etc. represent the main characteristics of the "4th Industrial Revolution", which in SML systems will also serve to support our customers with their production activities.

Quality

Ideal stretch film winders for perfect rolls

In past editions of "Technology Report", we have presented many of our various machine concepts and our successful approach as the market leader in stretch film machinery. Regular readers have also certainly noted the wide range of winders that SML offers for stretch film and may well have asked themselves, why so many alternatives are available for one product. The simple answer is that stretch film constitutes more than just a single item.

Accordingly, from a portfolio of three different winder families, SML offers the solution that best matches the customer's individual requirements with regard to winding quality, width and core diameter flexibility, the space available for the machine, and requirements for downstream automated roll handling and packing systems.

THE „MULTITALENTED" WINDER

At present, the most commonly used stretch film winder is the turret winder W4000, which comes in the 2S or 4S versions for 1,500 to 6,000mm (3-up to 12-up) film widths, and provides the highest possible winding speed. For the larger widths, this winder can be designed with double or even triple turrets, as well as with overlapping turrets for large 750 and 1,000mm width rolls. The 2S version represents the "workhorse" for machine rolls and jumbos at a very economic price, while the 4S version with four winding shafts furnishes maximum flexibility and product quality.

Winder W3000-4S – the shaftless model

THE „SHAFTLESS" WINDER

The winder W3000 is a completely different type of winder. It offers a unique technology, as direct clamping of the cores between special chucks renders winding shafts unnecessary, thereby ensuring that no critical resonances occur. Furthermore, this winder operates without bleed trim cut, which allows a smaller extrusion die and a lower re-feeding rate of material into the process. Consequently, this compact winder is very interesting for the retrofitting of old machines when the die width is insufficient for increased speed with bleed trim cut. The winder W3000 is also an interesting alternative to conventional shafted winders for the production of stretch film with standardised roll widths on either 3" or 2" cores.

Last, but not least, a third version is the universal winder W2000-stretch which still has a place in our portfolio. This winder is the best choice for 3" / 4.5" or 6" cores in widths from 1,500 to 2,500mm for the production of machine rolls and large jumbos up to 800mm diameter for rewinding processes. A strong cutting device handles film thicknesses of up to 100µm, and the winder design facilitates the production of mother rolls in full production widths, which for example is interesting in combined stretch / CPP film lines.

Winding	Winder W4000-2S	Winder W4000-4S	Winder W3000-4S	Winder W2000-stretch
Thickness range	8 - 50µm	8 - 50µm	8 – 50µm	8 – 100µm
Max. mechanical speed	850 m/min	850 m/min	650 m/min	600 m/min
Winding width	3 – 12 x 500mm	3 – 8 x 500mm	3 – 6 x 500mm	3 – 5 x 500mm
Part roll width	Variable	Variable	400, 450, 500mm	Variable
Winding on 2-inch / 3-inch / 6-inch	No / Yes / No	Yes / Yes / No	Yes / Yes / No	No / Yes / Yes
Coreless winding	No	Yes	No	No
Max. diameter 2-inch / 3-inch / 6-inch	– / 425 / – mm	160 / 425 / – mm	160 / 400 / – mm	– / 400 / 800mm
No. of winding stations per turret	2	4	4	Horizontal sliding system
No. of winding turrets	Single / Double / Triple	Single / Double	Single	Horizontal sliding system
Minimum cycle time	60s	≤ 20s	≤ 20s	90s
Film tail	Standard	Very short	Very short	Short
Bleed trim	Yes	Yes	Bleed trim-free	Yes

Features, that include the following, make the 4S version of the winder the most versatile on the market:

- 2" / 2.5" and 3" operation for hand rolls, machine rolls and jumbos
- Roll widths from 250 to 1,000mm
- Short tail due to an auxiliary contact roll for roll changes
- Cycle times below 20s
- Thin core technology and coreless winding technology
- Modified edges

SML provides DC Carpets with some BCF magic

Founded in Deerlijk near Kortrijk in western Belgium during 1963, the family-owned concern Devos Caby NV, or DC Carpets for short, began as a supplier of upholstery materials, but soon switched to carpet weaving. The company is now one of the top ten manufacturers of woven carpeting in Belgium and a major, international carpet trade player. Moreover, it remains on a worldwide expansion course via mills that employ locally purchased raw materials such as PP.

A significant factor in this success has been a very close watch on market trends, because like haute couture floor coverings are subject to changing tastes. Consequently, as Export Manager, Joe Van Herzeele, explains: "We maintain intensive communications with our customers and use the resultant feedback to adapt our production programme to their needs." This approach is reflected by portfolio updates throughout the year and ongoing efforts to increase the production of high quality carpeting.

It is therefore no surprise that in 2015, DC Carpets launched a series of BCF carpet yarn tests using Austrofil spinning lines from SML because yarns produced on its equipment represent a carpet industry benchmark. This is due to the fact that outstanding levels of cooling efficiency after texturing result in high output and excellent yarn quality. Cam rolls are also available as an option and these enable the creation of carpets with a special design appearance. In addition, a patented SML texturing unit provides top and uniform crimp structure and low shrinkage, while an extensive titre range can be produced without changes to the components in the patented texturing system. Last, but by no means least, two pre-intermingling positions allow a wide range of colour separations (from melange to sprinkle) in a configuration, which is used in the carpet industry to produce unique yarns according to individual requirements and meet fresh market trends.

It was precisely this blend of style, versatility and quality that DC Carpets was seeking to match its business strategy and in view of the more than satisfactory test results, in 2016 it purchased Austrofil Twincolour BCF lines for both Russia and Indonesia. In the same year, an order followed for a BCF-Tricolour line for Russia and this September a contract was signed for the delivery of a BCF-Tricolour line to Indonesia during 2018. Moreover, a number of other joint projects are already under consideration. This cooperation demonstrates clearly that SML continues to more than fulfil DC Carpets' expectations with regard to multiple colour combinations, maximum carpet design efficiency, flexibility and customer service.

Looking ahead

SML is meeting the PET challenge

EUROPEAN COMMISSION'S ENVIRONMENT ACTION PROGRAMME (EAP)

It is estimated that the world's oceans already contain some 140,000,000t of waste, a large percentage of which consists of plastic waste, which when subjected to sunlight disintegrate into tiny platelets. These particles then enter our food chain via fish and other sea creatures, and are also to be found in marine mammals such as whales. It is therefore hardly surprising that the global pressure on both the political and business spheres for bans on single use plastics is mounting, or that initiatives such as the European Commission's 7th Environment Action Programme (EAP), which is intended to help guide the EU response to environment issues and climate change up to and beyond 2020, have been launched.

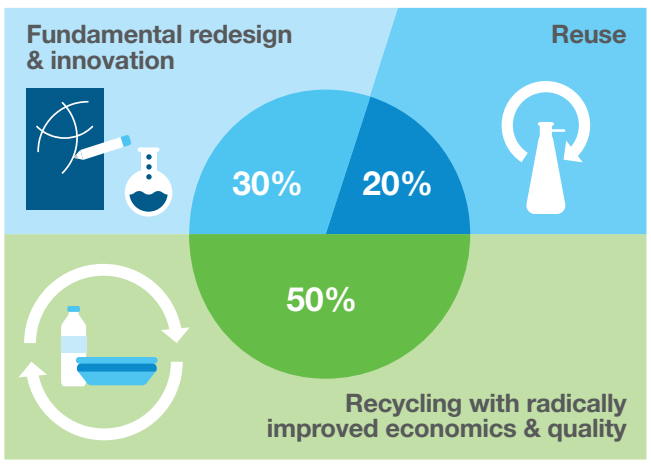
Key objectives of the EU programme

- Protection and conservation of natural capital
- Transition to a resource-efficient economic system
- Protection of citizens against environmental influences that pose a threat to the human habitat and health

In view of these developments, plastic packaging will only strengthen its future when the recycling quota is increased. Fortunately, progress is being made with regard to close operation loop and through its technological know-how SML is playing a significant role in this connection.

The Ellen McArthur Foundation suggests a sustainable approach to the plastics loop

- 30% saving by innovation and redesign
- 20% saving by reuse
- 50% recycling with radically improved economics & quality



(c) World Economic Forum and Ellen MacArthur Foundation, The New Plastics Economy – Catalysing action (2017, http://www.ellenmacarthurfoundation.org/publications)

RESOURCE EFFICIENT TECHNOLOGIES BY SML

SML's contribution to this progress is threefold. First of all, it provides treatment for the various types of recycled PET raw materials. Bottle flakes and amorphous regrind are either dried using a combination of infrared and dry air, or in a vacuum reactor, which dries, crystallises and decontaminates the recyclate. The top melt quality of the recycled PET material is thus guaranteed and downstream extruders and sheet calendering subsequently provide sheets with thicknesses of up to 1,800µm and less IV degradation.

The second aspect of SML's approach to the PET issue involves down-gauging and physical foaming. The former may involve the use of a MDO orientation unit, which facilitates the production of films in a thickness range of 15 to 50µm. These have a fine grain crystallinity, which makes them resistant to ageing and heat, but does not affect their transparency and gloss. The layer distribution in a typical MDO PET film is 10 / 80 /10% with recycled content in the middle layer. The resultant films are suitable for product applications such as food packaging, shrink labels and adhesive tapes.

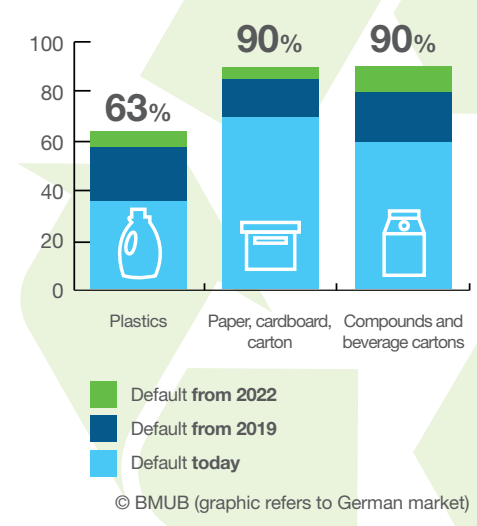
Physical foaming in PET utilising nitrogen or CO_2 reduces the raw material requirement by some 40%. Foamed PET is not only 10 to 15% lighter than PS, but in terms of the raw material price, also over 40% cheaper. The end product is employed in areas such as cups or food trays.

SML's machinery portfolio is targeted on the widest possible production of PET films with a maximum recycled material content, using recycled bottle flake material and other regrinds. An example is PET/ PE composite barrier films for food packaging. Another application is PET decorative sheet, glossy or matt structured, with a PETG or APET formulation.

LEGISLATION

SML is thus helping to support a sustainable product loop and the achievement of targets such as those required by the latest German environmental legislation. The German Packaging Law, effective by 1st of January 2019, stipulates an improvement in the plastic packaging recycling quota from its current level of 36 per cent to 63 per cent by 2022.

Higher recycling rates stipulated by the German Packaging Law



© BMUB (graphic refers to German market)

These, and similar statutes worldwide, also envisage the rewarding of manufacturers, who integrate recyclates and recyclability into the design of their packaging, and increase their use of polymers based on renewable resources. A further opportunity that can be seized by means of SML's sustainable, technological answers to the PET issue.

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Events 2018

Event	Location	Booth No.	Date
SAUDI PPPP	Riyadh, Saudi Arabia	514.2	January, 21 - 24
INTERPLASTICA	Moscow, Russia	8.1 / A16	January, 23 - 26
PLASTINDIA	Gandhinagar, India	8B23	February, 7 - 12
BREATHABLE FILMS CONFERENCE	Cologne, Germany		March, 7 - 8
PLAST ALGER	Algier, Algeria		March, 11 - 13
PLASTICS & RUBBER VIETNAM	Ho Chi Minh City, Vietnam		March, 20 - 22
CHINAPLAS	Shanghai, China		April, 24 - 27
NPE	Orlando, USA	W6185	May, 7 - 11
PLAST MILAN	Milano, Italy	Hall 15/C71	May, 29 – June 1

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