SML TECH REPORT

Nº43 / 01-2024

2-meter stretch wrap film line

EcoCompact® II – fully revised and extended

The 2-meter *EcoCompact*® II features a number of technical innovations, packed in a fresh new design. Like its predecessor, it combines a compact line set-up with excellent components and maximum flexibility, while still maintaining an affordable price.

New EcoCompact II stretch film line with double turret winder W4000-WS

At K 2010 trade fair, SML introduced the *EcoCompact*®. A standardised 4 up (2,000 mm) wide stretch film line with premium components, an extremely compact design and a reasonable price that revolutionised the market. "The *EcoCompact*® was a hot seller right from the go. Now, 14 years later, it is time for a total refinement," Thomas Rauscher, Product Manager at SML states.

UP TO SEVEN EXTRUDERS, NANOLAYER, AND SML'S Ø 1,600 MM CHILL ROLL

To cover almost every potential demand in production, the *EcoCompact*® II comes in four pre-configured versions, ranging from a minimum of four extruders to a maximum of seven extruders. Beside 5-layers and 7-layers versions, the line can be optionally fitted with Nanolayer-Technology. SML's well-known Ø 1,600 mm chill roll unit and an e-container are now included as a standard.

HIGH PERFORMANCE WINDERS

The winder is a key part of any stretch film line. In the *EcoCompact*® II, customers can choose from three different versions of SML's powerful winder W4000: A 2-shaft version, the well-known 4-shaft type and, last but not least´, a double turret winder with a total of 8-shafts. "The advantage of the 8-shaft winder is the ability to use 2" winding cores for hand rolls. Generally, this type of winder is capable of running at very high speeds. This boosts the performance of the *EcoCompact*® II to the next level," Thomas Rauscher says.

ULTRA-FAST AND HANDS-FREE DIE LIP CONTROL

As a standard, the *EcoCompact*® II comes with a Cloeren Reflex die, the benchmark technology for ultra-fast and hands-free die lip control. It can be upgraded with an automatic die mapping system.

Also available are cut resistance rollers, coreless winding, modified edges and much more. "Thanks to the comprehensive technical possibilities of the 2-meter *EcoCompact*® II, flexibility in stretch film production is guaranteed," Thomas Rauscher from SML concludes with pride.

Editorial

Karl Stöger
Managing Director

Dear Reader,

This issue of Tech Report demonstrates once again that SML consistently keeps developing advanced technologies for their customers. Although market demand has been somewhat stagnant in recent times, I strongly believe that the overall market potential for the film, sheet and coating extrusion industries will continue to rise steadily in numerous applications, simply because plastics are, in many cases, the best-suited material for the task.

Survival of the fittest implies that one must continue to adapt and readjust the applied technology, in order to cater to the ever-changing requirements of customers, brand owners and consumers. In addition, stricter legislation and ambiguous regulations – like the new European PPWR (Packaging and Packaging Waste Regulations) – urge action and press for solutions to avoid wastage and increase recycling rates. All these are important aspects our R&D engineers have been working on extensively in recent years.

Therefore, we can provide our customers with all the necessary machinery and accessories required to produce sustainable packaging materials that ensure commercial success with plastics. Our extrusion lines are highly capable of manufacturing products that are designed for recycling and, on top of this, most products can be produced from high percentages of recycled materials.

In this context, I would like to announce the "SML Innovation Days" on 9-10 October 2024. In addition to presentations of our technical product news, our latest extrusion lines will be live on display here in Redlham, Austria.

Trusting that the information compiled inside this Tech Report will be interesting and enjoyable to read, I remain with kind regards.

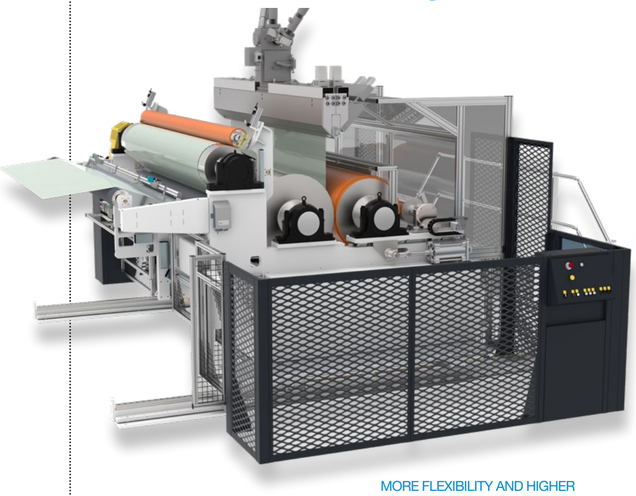
Sincerely yours,

Karl Stöger

Extrusion lines –
engineered to perform

Innovations for hygiene film

Clear, compact & safe – new melt embossing unit



The melt embossing units for SML's cast hygiene film lines have been completely redesigned. The new units are characterised by their clear and compact set-up, easy operation and, above all, increased occupational safety in accordance with the standard EN 12301.

"SML has been supplying cast film lines for hygiene products, like diapers, to customers all over the world for more than 25 years. The continuous and ambitious further development of the line components had a vital role in enabling production speeds to be increased whilst at the same time reducing the film grammage," Alexander Bruckmüller, Product Manager at SML explains in detail. SML strives constantly to enhance the lines' efficiency and product quality, but it is also aware of its responsibility towards the people who operate these machines on a daily basis.

OCCUPATIONAL SAFETY REGULATIONS FULLY MET

The new design of the dry melt embossing unit in SML's cast hygiene film lines helps to ensure the occupational safety for the operators during production. It fully complies with the calander standard EN 12301. Accordingly, the embossing gap is completely encapsulated and no longer accessible to the operating personnel during production. In addition to the compliance with safety regulations, the maintenance-friendliness of the unit has been increased. And it has become much easier to replace the embossing roller and the nip roller.

ADVANTAGES OF DRY MELT EMBOSSING

Compared to wet melt embossing units, SML's compact and easy-to-operate dry melt embossing units do boast several advantages:

- **no water treatment required**
- **no risk of algae / bacteria formation**
- **Clean process – longer maintenance intervals**

MORE FLEXIBILITY AND HIGHER EFFICIENCY THAN BLOWN FILM

One of the general advantages of a cast hygiene film line over a blown film line is that all three common types of hygiene film can be produced in-line on one and the same machine:

- **Melt-embossed film**
- **Breathable film**
- **Cloth-like laminates**

These materials can be used for a wide variety of products such as baby diapers, incontinence products, feminine hygiene products, bed pads, surgical drapes, and lots more. At the production stage, the edge trims of all three film types can be fed back into the production process in-line, which leads to significant cost and energy savings. Further advantages of the cast process compared with blown film are that the film is softer and more matt as a result of the film being embossed.

In addition to the products mentioned above for the hygiene sector, SML's hygiene film lines can also be used to produce films for the construction sector (house wrapping membranes / roofing film), the agricultural sector (mulch film) and the medical sector.

SML launches new hotmelt lamination line

In combination with SML's market-proven hygiene cast film lines, the new hotmelt lamination systems promise new opportunities for the vertically integrated production of premium materials for diapers, incontinence products, protective clothing and lots more.

SML's brand-new coating lines for the hotmelt lamination of breathable laminate structures are highly impressive particularly when it comes to their straight-forward set-up, simple processes and high efficiency.

DEMAND FROM THE HYGIENE INDUSTRY

"We decided to launch our new hotmelt lamination system because we see a need for lean, easy-to-use solutions in the hygiene industry. Another incentive to develop this line was simply that we have the skills to do this.", Johannes Danter, Product Manager at SML explains. In the last few decades, SML has constructed dozens of cast film lines for the production of polyethylene and polypropylene-based breathable films and has firmly established itself as a partner for the hygiene industry. The new lines for hotmelt lamination are a logical extension of SML's existing range of products in this area.

STRAIGHTFORWARD PROCESS, INTUITIVE LINE OPERATION

In the new hotmelt laminator, the hotmelt is fed onto the substrate surface via a slot die in kiss mode. The very simple handling of the hotmelt represents a key characteristic: The hotmelt is heated in drum melters instead of in an extrusion process and is then passed on to a tank melter. Application pumps which work with precision contribute quite significantly to the optimum dosing of the melt, also with regard to the internal deckling system, which allows the continuous adjustment of the coating width during the production process. The hotmelt lamination section of the line is fully integrated into the line's intuitive and easy-to-use machine control system SMILE, which guarantees the perfect interaction of all machine components.

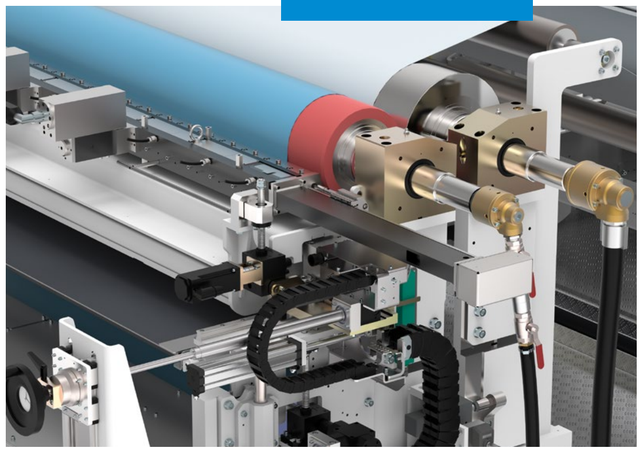
MARKTEN-PROVEN UNWINDING TECHNOLOGY

"In this new line, we are offering our market-proven and optimized semi or fully automatic unwinding equipment paired with SML's state-of-the art winding technology. Part bobbin production can be integrated in a way tailored to specific customer requirements," Johannes Danter explains.

DOUBLECOAT TECHNOLOGY AS A BASIS

Most of the technology applied in the new hotmelt lamination process was originally developed for SML's patented DoubleCoat process, a combination of hotmelt application to the substrate with immediate extrusion coating. The DoubleCoat process used in SML's coating and lamination lines allows the manufacturing of ultra-thin membranes with extraordinary properties in terms of breathability and adhesion, with minimum raw material requirements and production costs. It can be used in a wide range of applications with unparalleled product features, ranging from tents to surgical coverings and further to membranes for the construction industry. The DoubleCoat process is an indispensable method today particularly for the production of high-quality roof underlays.

The hotmelt laminator impresses with straightforward set-up, simple process and high efficiency.



Performance test:

PCR and nano-layer in stretch film production

The basic idea of nanolayer technology in stretch film production is to create thin, composite structures by repeatedly layering the melt from at least two extruders to attain improvements in the film performance. A central question arises in connection with the use of post-consumer resin (PCR): Does the use of PCR work when producing these layers? SML has made extensive trials to get the answer.

Nanolayer technology entered the market some years ago. The centrepiece of this technology is a feedblock which enables a significantly higher number of layers than conventional feedblocks. Together with Cloeren, SML has successfully installed feedblocks for up to 67 layers. So which effects has the use of PCR in combination with nanolayer technology?

TWO IDENTICAL POWERCAST® XL TEST LINES

To answer this question, SML teamed up with Brazilian resin manufacturer, Braskem, and devised a practical test plan to compare the use of PCR with conventional and nanolayer technology in regular production conditions. In the next step, SML set up two identical *PowerCast® XL*, 9 up cast stretch film lines with 7 + 1 extruders in the Technology Centre of its headquarters in Austria. The only difference between the two lines: The number of layers on the feedblock. The conventional extrusion line was designed for 13 layers, whereas the line with the nanolayer feedblock produced 67 layers.

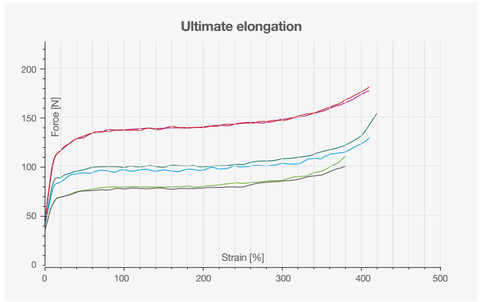
EXTRUSION RUNS WITH A MULTITUDE OF DIFFERENT PARAMETERS

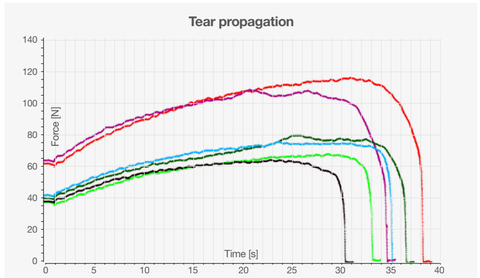
The trial plan involved various recipes, line speeds, types of PCR, as well as a multitude of other parameters. Finally, more than 100 different test runs had been done, but the proportion of PCR always remained at 30 % altogether. An in-depth analysis of more than 1,000 lab tests followed the test runs.

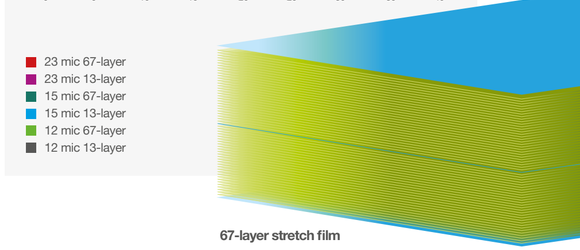
THE RESULT: NO LIMITS!

"We did not see or detect any aspect which would restrict the film performance or production parameters using the same amount and quality of PCRs on nanolayer equipment compared to conventional co-extrusion. As you can see from the charts, the ultimate elongation and tear propagation are at the same level," SML Product Manager Thomas Rauscher sums up the test.

For further information on the tests and about the use of PCR in nanolayer technology, please contact: Thomas Rauscher, rat@sml.at







Extended product range – higher flexibility

Austrofil® HT spinning lines adapted to process PA6

SML's Austrofil® spinning lines are well established in the market and known for the production of a great variety of different high-tenacity yarns from PP. Supplementary, they also process PA6 to tear-resistant premium yarns.

The added flexibility enables a wealth of new opportunities, not least for manufacturers of smaller batches of coloured yarn. High-tenacity yarns made of PA6 are primarily used for applications such as fishing nets, tire cord, special ropes or safety nets.

"With the ability to produce PA6 yarns with excellent mechanical properties on SML's Austrofil® HT spinning lines, manufacturers of high-tenacity PP yarns can expand their product range and machine capacity utilisations and as a result the profitability of the line itself", Stefan Dambauer, Product Manager at SML, explains.

ADVANCED EXTRUSION AND HEAT TREATMENT

The processing of PA6 on SML's HT Austrofil® spinning lines is made possible first and foremost thanks to SML's versatile extruder. Combined with a subsequent static melt mixer, this guarantees both a high melt quality and homogeneity for all polymers. A maximum yarn tenacity is attained, above all, with SML's unique heat treatment system – a hot air oven. Additionally, the specific horizontal yarn path promotes the creation of PA6 yarn with maximum tenacity values. Both PP yarn and yarn from PA6 are treated in a two-step stretching process. Compared to other machinery concepts, SML's straightforward technology helps to save energy and minimizes maintenance costs.

FAST PRODUCT CHANGES – SOLUTION-DYED YARN

In addition to the high flexibility with regard to different yarn types, rapid and uncomplicated product changeovers play a decisive role when it comes to the profitability of Austrofil® HT lines. Unlike the usual process in large-scale plants, the dyeing of the yarns can take place in line with easy-to-handle masterbatches. Fast colour changes contribute significantly to the overall production efficiency. With output quantities of up to 160 kg for PP and of up to 110 kg for PA6, SML's Austrofil® HT spinning lines guarantee maximum efficiency with smaller batches.

EASY OPERATION

SML Austrofil® HT spinning lines have been market-tested hundreds of times, and the first plants processing both PP and PA6 are already in operation at customers. Every line can be comfortably operated and controlled by SML's advanced control system SMILE, a software solution that supports complete remote control and easy maintenance. SML's digital data generation and analysing tool *bitWise®* provides a wide range of opportunities for data-driven decisions, and its focus on the optimisation of production processes is another clear advantage.

HORIZONTAL DESIGN FOR LOW CEILING HIGHTS

Finally, the compact design and the horizontal line set-up with the specific yarn path allow the installation of Austrofil® HT spinning lines at sites with a ceiling height of only 7 metres. For further information on the wide range of possibilities offered by SML's new Austrofil® HT spinning lines, please contact: Stefan Dambauer, dab@sml.at.

Anti-block: Masterbatch vs. liquid application – what is more economical in PET sheet production?

Blocking is the effect when calendered PET sheet can no longer be separated from each other after winding. A common method to prevent this from happening is to add masterbatch to the extrusion process. An alternative is the application of anti-block liquid to the surface of the sheet. To find out which method is more economical under which conditions, SML has made some investigations.

"The blocking of sheet generates difficulties. Unwinding might become troublesome or even impossible, thermoformed cups and trays can no longer be unstacked. As measures to avoid blocking contribute quite significantly to the overall production costs of the sheet, we have compared the costs of masterbatch to the costs of anti-block liquid," Martin Kastner states.

CALCULATING THE COSTS FOR MASTERBATCH

To calculate the cost of masterbatch, it is important to differentiate between coextruded and mono sheets. Whereas in co-extruded sheet - with a coex layer structure A/B/A - the masterbatch is only added to the outer layers (A layers), in sheet with a mono-layer structure the quantity of masterbatch is determined on the basis of the total sheet mass. Thus, the formulas for calculating the costs for masterbatch are as follows:

Coex-layer structure A/B/A

$$€_{Masterbatch} = m_{A-layer} \times i_{MB} \times €_{MB}$$

Mono-layer structure

$$€_{Masterbatch} = m_s \times i_{MB} \times €_{MB}$$

$€_{Masterbatch}$ ___ costs for masterbatch [EUR]
$m_{A-layer}$ ___ mass of A-layer in coex-layer structure [kg]
m_s ___ mass of sheet in mono-layer structure [kg]
i_{MB} ___ percentage of dosed masterbatch [%]
$€_{MB}$ ___ costs for masterbatch [EUR/kg]

CALCULATING THE COSTS FOR ANTI-BLOCK LIQUID

The costs for two-sided anti-block liquid (AB liquid) application are calculated by multiplying the total surface area of the sheet by the price per unit area of AB liquid. As subsequent drying is necessary with this method, we have to add the energy costs for drying the sheet after application:

AB liquid both sided

$$€_{AB\ liquid} = A_s \times m_{AB\ liquid} \times i_e \times €_e + E_d \times €_e$$

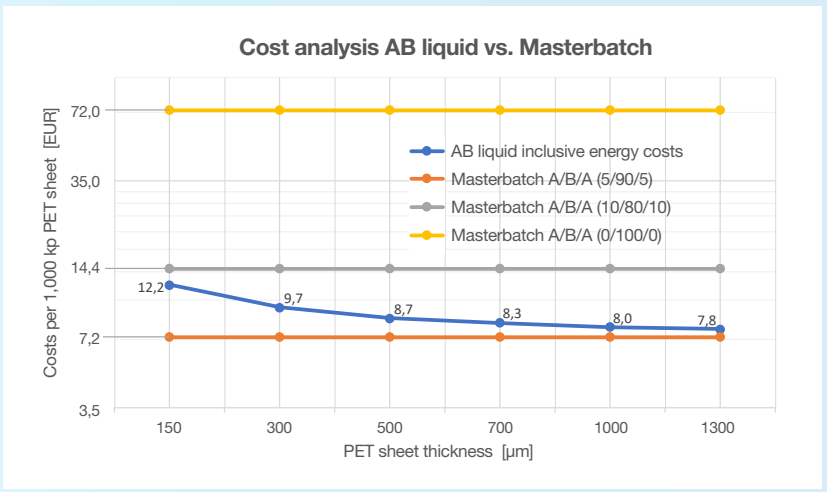
$€_{AB\ liquid}$ ___ costs for AB liquid [EUR]
A_s ___ sheet surface [m²]
$m_{AB\ liquid}$ ___ applied AB liquid [kg]
i_e ___ percentage of emulsion in AB liquid [%]
$€_e$ ___ costs for emulsion [EUR/kg]
E_D ___ energy consumption drying unit [kWh]
$€_E$ ___ energy costs per kWh [EUR/kWh]

COST ANALYSIS MASTERBATCH VS. AB LIQUID

"In order to compare the two methods, we based our calculations on the production of 1,000 kg of PET sheet with a film width of 1,250 mm and a line throughput of 1,000 kg/h with several sheet thicknesses," Martin Kastner says.

The calculations for the cost of masterbatch were made on a dosing quantity of 1.5 % and an average masterbatch-price of 4.8 EUR/kg.

For an equal outcome with AB liquid, this calculation is based on a 5 % emulsion with an application of 2 g/m² on both sides. Emulsion costs are calculated as 5 EUR/kg. The energy costs for the subsequent drying process were set at 0.15 EUR/kWh which were valid at SML at the time.



MASTERBATCH

"As our chart demonstrates, the amount of masterbatch required in co-extruded A/B/A film depends only on the mass of the A layers - and therefore on the layer distribution of the A/B/A layers," Martin Kastner explains. The bigger the proportion of A layers, the bigger the mass of the A layers, and consequently the bigger the amount of masterbatch required. As the example in this chart shows: For a 10/80/10 film, the costs for 1,000 kg of PET sheet amount to EUR 14.4. If the proportion of A-layers is reduced by half (layer distribution 5/90/5), the costs are also halved to EUR 7.2. Changing the film thickness has no effect on the costs per kg of film.

"When producing monofilm (0/100/0) the 1.5 % of masterbatch, on which our calculation is based, must be used in relation to the total 1,000 kg film mass we have assumed. As we can see in the horizontal line on the top of the chart, the masterbatch costs of 72 EUR per 1,000 kg PET film are extraordinarily high," Martin Kastner says.

AB LIQUID

In contrast to masterbatch, the amount of AB liquid required does not depend on the layer distribution of the film, but on the film thickness. The thicker the film, the smaller the film surface in relation to the mass of the film, and the lower the amount of AB liquid required. "Our example demonstrates that the pure costs for the emulsion are EUR 5 for a 150 µm thin film, and then fall as the film thickness increases. At 1,300 µm they are only EUR 0.6," Kastner continues.

Then, the energy costs for the drying section are included in the calculation. With an assumed energy price of EUR 0.15/kWh, as is currently usual for Central Europe, energy costs represent a significant proportion of the total costs. As this chart shows, the costs for AB liquid including energy costs amount to EUR 12.2 for a 150 µm film. For a 1,300 µm film, the costs are EUR 7.8.

COMPARING COSTS FOR MASTERBATCH VS AB LIQUID – PRACTICAL EXAMPLES:

A comparison of the two methods for the production of 150 µm thin film shows that masterbatch at a layer distribution of 5/90/5 is the cheapest option, with EUR 7.2 per 1,000 kg of PET film. If the same film is produced with a layer distribution of 10/80/10, the costs for the masterbatch amount to EUR 14.4 and are therefore EUR 2.2 higher than when using AB liquid (EUR 12.2). If the film is produced as a monofilm, the masterbatch costs EUR 72, which is EUR 59.8 more than for AB liquid.

The thicker the film produced, the more the costs for AB liquid decrease, while the costs for the masterbatch remain constant. With a film with a thickness of 1,300 µm, AB liquid costs only EUR 7.8 for 1,000 kg of PET. Compared to masterbatch with a layer distribution of 10/80/10, this translates into potential savings of around 46 % (6.6 EUR).

Finally, comparing the costs on a yearly basis: When we take a 10/80/10 film with a thickness of 500 µm and an annual production of 10,000 tonnes manufactured under the conditions given above, the annual costs with AB liquid (including energy) amount to EUR 87.000. With the masterbatch on the other hand, the costs total EUR 144.000. Using AB liquid instead of masterbatch, helps to save EUR 57,000 per year!

"Depending on the sheet manufactured, the use of AB liquid can lead to significant cost advantages compared to masterbatch. We are happy to give our customers further insights into this topic and explain the specific advantages they can realise with our applicator unit", Martin Kastner concludes.

SML applicator unit for AB liquid Scan for more information:

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