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Editorial

Karl Stöger
Managing Director



Dear Reader,

This Tech Report is aimed at anyone interested in news about the latest extrusion technologies offered by SML. We do our best to provide insights into specific new features developed for our extrusion lines and to this we add market news and announcements relating to recent activities.

It is obvious that global economies have encountered considerable difficulties in 2023 and the overall recessionary environment has not left the plastic and packaging industries, which we serve, unscathed. I sincerely hope that your own business has not been impacted too harshly during this stormy period. To be honest, we do perceive a slowdown in certain segments and markets, and at the same time, an increased demand in other specific segments and areas. There is a shift to new technologies that help address environmental concerns. Appropriate technologies enabling a higher degree of recyclability and systems that help to save valuable resources like energy, raw materials and finally human labor are key here. Some of the new technologies that enjoy great demand are described on the following pages.

The cover page of this Report is devoted to the latest version of our cast film line with a brand new MDO unit installed in our technology center. The line has proved to be a great help for our customers to perform test runs and sample production. Oriented films for mono-material packaging solutions are of increased importance to the world-leading brand owners. As recyclable packaging is gaining significance and as a result these films are rapidly becoming a top seller in the market.

Another special film that is produced on SML lines and that has enjoyed exponential growth rates in recent years is the separator film for lithium-ion batteries. The latter is used in the growing market for electric-driven vehicles and the demand will continue to expand further. On the following page you will find information on how LIBS-film is best produced through our environmentally-friendly dry process.

Large drinking cups are either made from PE coated paper, PP or PET. Each material has its own advantages and disadvantages, but when it comes to recycling, PET is the clear favorite for closed-loop food packaging. We have vast experience and numerous customers world-wide who produce thick as well as extra-thick APET sheet for the thermoforming of large drinking cups.

Particularly today, in a period of high energy prices, new drive systems that are more energy efficient are important to stay competitive. As an option, we can offer motors with the highest energy efficiency class IE4 on our extrusion line. Read how these motors might help you to lower your overall production costs.

I trust we have compiled information which will be useful for you. I hope that you will enjoy reading it.

Yours sincerely,

Universally applicable:

Latest Version of SML's Multi-Purpose Cast Film Line with new MDO unit



SML has just set up the newest version of its multi-purpose cast film line in its Technology Centre. The line is universally applicable and features a number of technical innovations: Above all, a further-developed MDO unit.

“Our new multi-purpose cast film line will not fail to impress even long-serving experts. The line has the technical capacity to fulfil almost every customer requirement in cast film production”, Elias Mayrhofer, R&D Engineer at SML, comments with pride. The cast film line is ready for the production of CPP, CPE, Cast-PET, barrier, as well as for mono-oriented films. The application areas are comprehensive as well: They range from film for metallised and laminated standard food and non-food packaging to easy-to-recycle stand-up pouches of MOPE film and further to label film, and also include technical products like cable insulations and easy-tear MOPP film. Despite its wide functional range, the line can be further optimised for the manufacturing of specialised products – assuring the highest efficiency and maximum quality.

COHERENT CONCEPT

“A central characteristic of all of our machinery is the coherent line concept that we continue to develop and optimise,” Elias Mayrhofer states. This is underlined yet again by the modern and clear design of SML's multi-purpose cast film line.

MDO UNIT FOR MONO-MATERIALS

One key innovation featured in SML's latest cast film line is the MDO unit, that is also designed for the manufacturing of easy-to-recycle mono-material films such as MOPP, MOPE and MOPET. With this MDO unit, properties such as the film strength in the machine direction, stiffness and puncture resistance are increased even further, while the film thickness and elongation in the machine direction are significantly decreased.

SML has streamlined the whole MDO process: The clean and straightforward design makes operation comfortable and provides sufficient space for maintenance offering easy access.

NEW ROLLER ARRANGEMENT – TIGHT STRETCHING GAP

One of the main technical features of SML's latest MDO version is the process-optimised roller-arrangement. The adjustment of the stretching gap takes place in a motorised fashion, making the operation and alternations for product changes quite simple. As the stretching rollers have a diameter of 220 mm, the stretching gap can be kept narrow in a range between 50 and 200 mm (free length of the film between the rollers). While the distances between the stretching rollers can be reduced to a few mm only. The positions of the nip rollers in the stretching area are adjustable too.

This ensures an ideal stretching process of the film, independent of the defined stretching gap.

COMFORTABLE SETTINGS WITH SML'S NEW HMI

Finally, all the process parameters of the MDO unit are digitally recorded and can be comfortably set and adjusted with SML's new HMI.

SML's new multi-purpose cast film line is available to customers for trials and sample production.

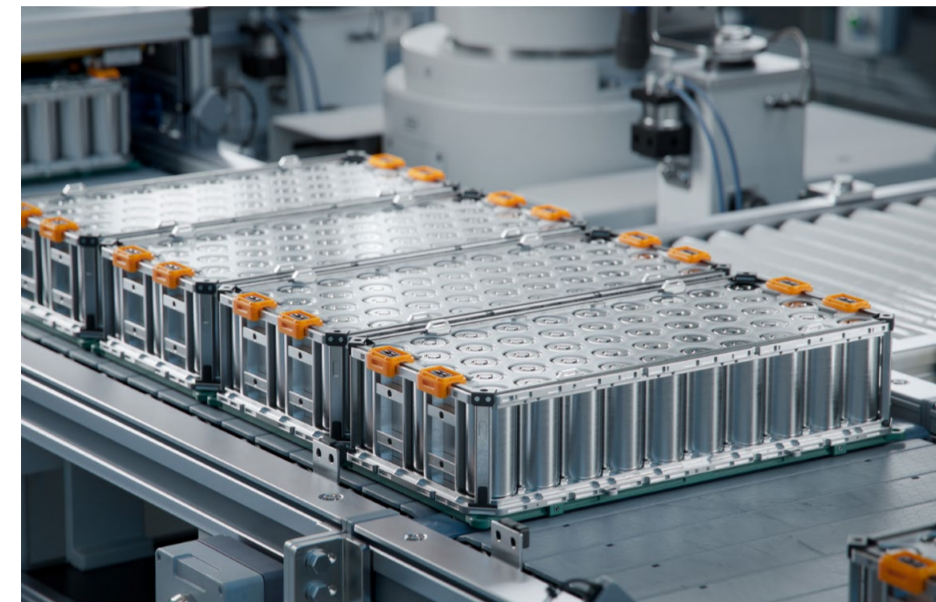
SML's new multi-purpose cast film line offers the following technical features:

- Five extruders for the processing of PP, PE, PA, PET, EVOH, as well as adhesives
- A seven-layer variable geometry feedblock with the possibility of numerous different layer arrangements
- Die width 2,850 mm, with internal deckling system two times 350 mm
- New MDO unit: maximum roll temperature of 160 °C, maximum stretching ratio 1:10
- Horizontal sliding winder for up to 4 part bobbins

Extrusion lines –
engineered to perform

Building up the market:

Strong demand for Lithium-ion batteries drives request for separator film



The growth rates are overwhelming: 14 million electric vehicles are expected to be sold in 2023 globally. Lithium-ion batteries power these new cars. They are the most popular rechargeable energy storage systems used today. A main component in each Li-ion battery is the separator film.

The separator is a porous film that separates the electrodes while enabling the exchange of lithium ions from one side to the other. SML is the number one machine manufacturer for separator film (LIBS film) made by the dry process. In the last decade, SML has delivered more than 90 cast film lines for separator film to leading Asian manufacturers – with ongoing orders in progress. “During this period, we had the opportunity to expand our technical and process knowledge in this specialised field. In collaboration with our customers, we constantly optimised our LIBS lines, increased line speeds and efficiency, and we are continuing to enhance the quality of our products,” Alexander Bruckmüller, Product Manager at SML, explains.

STRAIGHTFORWARD DRY PROCESS: RESOURCE-SAVING AND ECO-FRIENDLY
SML produces machines for the manufacturing of separator film in the dry process. Compared with the wet process, this provides several advantages: SML’s production method is market-tested and has proven to be both effective and straightforward many times over. It also requires fewer production steps. And, above all, the dry process is more energy-efficient, the material costs are lower, and it is more environmentally friendly as no solvents are needed. But what are the key stages when manufacturing separator film?

PRODUCING PRIMARY FILM ON SML’S LIBS LINES
Generally, separator film manufactured on SML’s LIBS lines is a 3-layer cast film, consisting of PP, HDPE or a combination of these

raw materials. The LIBS lines from SML are fitted with an extrusion unit with two extruders and a single or a multi manifold die. In the dry process, the melt pulled out of the die is oriented with a high draw down ratio. LIBS lines are equipped with a roll stack with up to 10 rollers for the optimum stabilising and annealing of the film. The thickness of the film is controlled by an automatic thickness regulation system. The winding station represents the final step in SML’s LIBS line. This is where premium nonporous primary film is wound to perfect rolls.

- ▶ **Annealing and stretching of the film** in several steps on a mono-oriented stretching system in order to optimise the crystalline structure and to create the film’s pore structure.
- ▶ **Disassembling into single films after the MDO process**
- ▶ **Optional ceramic coating** in order to increase the film’s temperature stability.
- ▶ **Sitting into the required end film width**

GOVERNMENT INITIATIVES BOOST INNOVATION

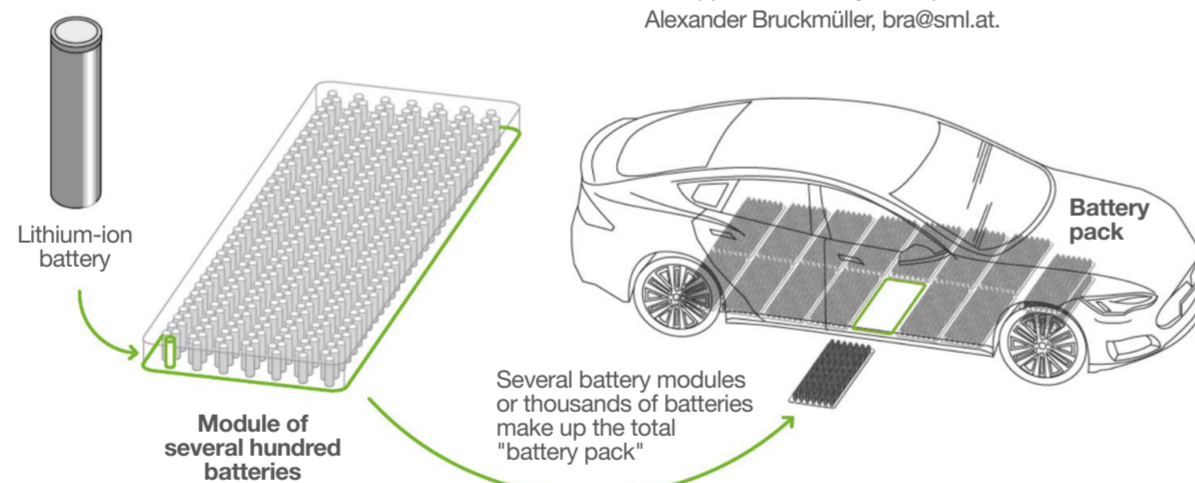
To benefit from this tremendous market expansion, several governments have started initiatives to set up their own battery industries and to boost innovations in these areas – for example, the EU initiative “European Battery Innovation”. SML globally supports all manufacturers who are interested in producing separator film efficiently and in an eco-friendly manner.

SUBSEQUENT PROCESSES AND TREATMENTS

The nonporous primary film is then further processed into applicable separator film. These are the essential downstream production steps:

- ▶ **Multiplying of films:** Several film webs are placed together to improve efficiency in the following stretching process.

If you would like to know more about SML’s advanced and market-tested LIBS lines and the opportunities they offer, please contact Alexander Bruckmüller, bra@sml.at.



Intensive testing: FlexPack® extrusion coating line



Performance tests, sample production and trial runs with customers have now commenced on SML’s new state-of-the-art FlexPack® line for extrusion coating and lamination. The industrial-scale pilot plant, located in SML’s Technology Centre, has been renewed and now features several technical innovations:

- ▶ Three extruders for processing a wide range of polymers, from polyolefins to TPU, TPE, PET, PLA and EVOH
- ▶ Enhanced power of the main extruder’s drive with screw speeds up to 425 rpm for an increased output with certain materials
- ▶ Co-extrusion feedback for up to five layers, enabling the production of barrier-coated film
- ▶ Smart Drain for fast and efficient polymer changeovers
- ▶ Infrared line scanner for the constant monitoring of melt homogeneity
- ▶ An additional single unwind to produce reinforced laminates
- ▶ Patented Double-Coat technology to create ultra-thin breathable membranes

For further information on the line’s technology, its capacities or the possibility to conduct customer trials or joint R&D, please contact: Johannes Danter, daj@sml.at

Retrofitting data analysis

Traceability for optimised processes

SML’s in-house developed data generation and analysis system which gives manufacturers a deep insight into the processes of an extrusion line is called bitWise. While bitWise is a standard feature in all new SML machines, older lines can now be retrofitted to ensure the traceability of manufacturing processes thus generating tangible technological and economic advantages.

bitWise enables the comprehensive collection, processing, analysis and transmission of manufacturing data – in an extraordinarily fast and easy manner. The process knowledge bitWise generates, helps to continuously optimise both the manufacturing processes and the product quality. This makes it easier to detect malfunctioning machine components and to improve a line’s efficiency.

FULL INTERCONNECTIVITY

One vital characteristic of bitWise is its system openness: The data exchange is based on open standards such as HTML and OPC-UA. So bitWise provides full interconnectivity for the comprehensive exchange of data between the extrusion line with its connected machine auxiliaries, cloud-based solutions or the ERP.

EASY RETROFITTING

Since 2020 all SML extrusion lines have



The traceability of production processes offers numerous advantages. It enables companies to improve the quality of their products and ensures that they meet the set requirements and standards.

Features of bitWise

- ▶ Web-App
- ▶ Easy integration
- ▶ Highly customisable

been equipped with bitWise but older machines can be retrofitted relatively easily. Generally, this is done by making the control unit ready for data exchange based on the OPC-UA standard. On lines with a newer machine control, OPC-UA can be activated using a simple software update without any modifications of the hardware. On other lines, either the control unit is changed completely or an additional controller is added for communication. Apart from the control of the machine, other components of an SML extrusion line, such as the thickness measurement unit, inspection devices or dosing units can generate data for bitWise, if they are connected via OPC-UA.

BITWISE TRACK & TRACE

Track & Trace is a popular key feature of bitWise. The advantages are clear: With Track & Trace, all of the data generated during production can be assigned to a specific finished film roll. This, for example, opens up new opportunities with regard to quality control and product enhancement. When a film roll is marked with a QR code, it is possible to exchange the data using a laboratory testing device, such as an ESTL FPT-750 film performance tester. The testing results can also be re-transferred to bitWise for further data processing.

WHEN DOES IT MAKE SENSE?

“bitWise is an excellent tool for manufacturers to optimise processes, to enhance the output quality and to constantly improve the overall line efficiency – when it is used actively,” Christoph Strasser, Team Leader Digital Business Unit, states. As with all matters related to retrofit, it is a question of weighing the investment costs against the benefits expected. To get detailed information about the various advantages bitWise offers, please contact Christoph Strasser directly: stc@sml.at

Crystal Clear big-size cups:

What to be aware of when calendering extra-thick APET sheet

Calendering is a common method to produce extra-thick APET sheet for the thermoforming of big cups containing up to one liter in Europe or 32 ounces in the US. To obtain a crystal-clear product, a couple of fundamental factors must be taken into consideration. The intrinsic viscosity (IV) of the melt is a key to any successful production.



“If a glass-like quality is required for thermoforming APET sheet in the range from 1,200 to 2,000 microns, manufacturing

becomes relatively demanding. Process knowledge is a basic prerequisite for a successful production,” Rupert Becker, Product Manager at SML, comments.

CHOOSING THE RIGHT RAW MATERIALS: IV VALUE OVER 0.78 G/DL

A highly viscous melt is essential for the production of crystal-clear, extra-thick APET sheet. Using raw materials with an IV value higher than 0.78 g/dl, in combination with pre-drying and single screw extrusion, guarantees minimum IV loss for the melt throughout the production process as a whole.

CALENDERING ON SLANTED ROLL STACKS

A slanted roll stack allows the highly viscous melt to stabilise before entering the nip, where the sheet thickness is determined. Disturbances or interruptions with regard to the melt bead can be largely excluded. This contributes enormously towards the formation of highly transparent APET sheet, the optical quality of which is comparable with PC or PMMA sheet, that are usually also manufactured on slanted roll stacks.

PAYING ATTENTION TO DETAIL

High quality components are important. To prevent scratches, dots or dents on the sheet surface and attain the demanded quality at high output, the surface of each roller – from the roll stack to the winder – has to be with premium surface finish.

The web guiding at all rollers, and especially the wrapping angles and the diameter of the guiding rollers, must be aligned for processing extra-thick sheet.

Last but not least, the optimum fine settings all over the process and the right tension settings on the sheet web are essential for successful production.

KEEP DUST AWAY

Crystal clear, extra-thick APET sheet should be produced in a relatively dust-free environment, as APET has a propensity for static charges. Otherwise, dust will be “sucked” to the sheet during production and can create scratches. “Dust might seem to be a tiny issue, but all of the measures mentioned above are null and void if the production environment is not relatively free of it,” Rupert Becker concludes.



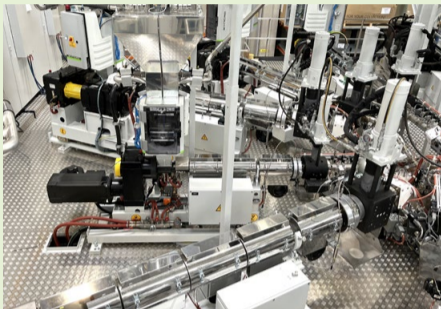
Big cup for 32 ounces / 1 litre

SML offers a number of different technologies for the production of APET. For extra-thick thermoforming sheet for crystal-clear applications, SML recommends single screw extrusion systems in combination with upstream dehumidifying dryers, where the raw material is pre-treated.

For more information about manufacturing extra-thick, glass-like sheet on a calendering line, please contact: Rupert Becker, ber@sml.at

Sustainability in Plastics Processing - The benefit of energy-efficient motors and drives

The responsible use of energy not only helps the environment. Managing power consumption is also crucial when it comes to bringing down over-all production costs. New types of energy-saving drive systems play a decisive role in this. So when should you consider replacing electric motors on your extrusion line?



The facts speak for themselves: Up to 50 % of the total energy consumed in a film extrusion line is accounted for by the electricity required to heat and run the extruders. The greater part of this energy consumption can be traced to the electric motors driving the extruder screws, dissipating the mechanical energy into heat.

MODERN FREQUENCY INVERTERS TO UNLEASH THE EFFICIENCY OF SRMS

To cut a long story short: The energy efficiency of an extrusion process depends to a large extent on the energy efficiency of the motor. 20 to 30 years ago, mostly DC brushed motors were state-of-the-art in extrusion lines. Depending on the make, their efficiency ranged between 75 – 80 % but hardly ever attained 90 %. Today, in most extrusion lines asynchronous motors (ASM)

are standard. Now, however, new types of synchronous reluctance motors (SRM), that outperform ASMs in many cases, are an available option. While the principle of SRMs was invented a long time ago, these motors only became established with the development of state-of-the-art frequency inverters. Unlike other new motor types, e.g. permanent magnet motors, SRMs don't rely on expensive copper or rare earth materials in the rotor design. So their price-performance ratios are well balanced, although there is an additional charge compared to ASM motors.

THINGS TO CONSIDER

Changing a working electric motor on an extrusion line into a new, significantly more energy-efficient drive system should be considered carefully when one or more of these facts apply:

- ▶ **The power-consumption of the motor is substantial**
- ▶ **High utilisation of the motor**
- ▶ **When a motor requires major repairs or replacement**
- ▶ **Investment in a new extrusion line**

ANTICIPATING NEW REGULATIONS

Motors with energy efficiency class IE 3 are standard for many applications today. Mandatory EU regulations even ask for an IE4 efficiency for all motors of between 75 – 200 kW motor power, if designed for 50/60Hz. Legislation in other parts of the world, e.g. China, is often in line with EU guidelines. The new, energy-efficient SRM electric motors, SML is offering as an option, outperform current

regulations for energy efficiency quite significantly – making extrusion lines also fit for the regulations to come.

EASY UPGRADE

The good news for manufacturers, who focus on the energy consumption of their lines: A move to a higher efficiency class motor does not necessarily require a modification of the machine. While IEC type asynchronous motors (ASM) often grow in frame size with increasing efficiency, certain synchronous reluctance motors (SRM) provide a better power utilisation without the need to increase the frame size. Hence SRMs are suitable for an upgrade of the existing extrusion lines.

ANALYSING ENERGY CONSUMPTION

SML is constantly improving the energy efficiency of its extrusion lines and supports its customers to make production processes more efficient. The data generation and analysis tool bitWise can play a significant role here. Amongst other things, it enables long-term recordings and the analysis of energy parameters, which help to detect energy losses and to optimise the overall energy efficiency of an extrusion line.

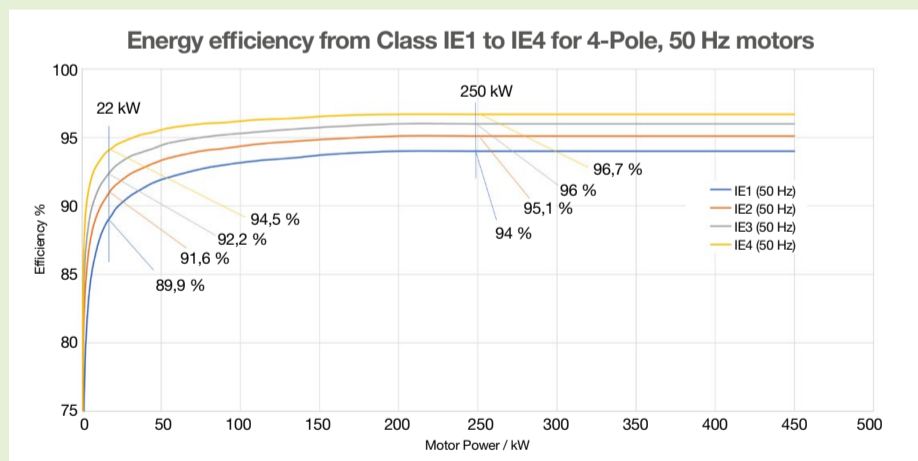
While extrusion is a highly efficient and cost-effective manufacturing process, there are measures to increase its efficiency even more. For additional information on this topic check out our article: "Energy-efficient extrusion: How can we lower energy costs?" in SML TechReport 2/2022. For further information on how to upgrade your line with efficient SRM motors, please contact Michael Kroiss, Spares & Retrofits, krm@sml.at

EcoCompact®: 2-Meter Stretch Film Line comes revalued

SML has upgraded its 2-meter EcoCompact® stretch wrap film line. The EcoCompact® comes in a fresh design. To cater all thinkable market demands, it enables a wider variety of individual layer structures as well as varying widths of the film rolls.

SML's EcoCompact® stretch film line was originally launched in 2009 as the first standardised, preconfigured line designed for a film width of 2 m. With its compact design (floor space of 140 m²) and maximum flexibility, EcoCompact® is particularly well-suited to medium-scale production runs. The line is characterised by its fast product changeovers. Its output rate is up to 1,600 kg/h.

And now the time has come for the next stage: The 2-meter EcoCompact® will provide a number of technical enhancements: special formats and roll cuts of 250 / 400 / 450 / 500 / 1000 mm will be possible for even greater flexibility in production. A new layout and different layer structures are additional characteristics of this new stretch wrap film line which will be available soon. If you are interested in the new EcoCompact® or if you would like to let us know what exactly you expect from a state-of-the-art 2 m stretch film line, please contact: Thomas Rauscher, rat@sml.at.



Addresses

SML - Head Office
Gewerbepark Ost 32
A-4846 Redlham, Austria
Phone: +43 7673 90999 0
E-mail: sml@sml.at
www.sml.at

SML - Machinery Far East Sdn Bhd
(1029958-P)
1201 Block B, Menara Amcorp
No.18 Jalan Persiaran Barat
46050 Petaling Jaya
Selangor, Malaysia
Phone: +60 3 7955 9098
E-mail: yen@sml.at

SML - Beijing Office
Unit 1410, Landmark Tower
No. 8 North Dongsanhuan Road
Chaoyang District
100004 Beijing, P.R. of China
Phone: +86 10 6590 0946
E-mail: sml@sml.bj.cn

SML - North America Service Inc.
Suite 204
85 Eastern Avenue
Gloucester MA 01930
USA
Phone: +1 978 281 0560
E-mail: jom@sml.at

Events 2023/24

Event	Location	Booth No.	Date
Plastex Egypt	Cairo, Egypt	1G43	09. - 12.01.2024
IPF Bangladesh	Dhaka, Bangladesh		24. - 27.01.2024
Stretch & Shrink Film	Bangkok, Thailand		27. - 28.02.2024
Plast Alger	Alger, Algeria		04. - 06.03.2024
Propak East Africa	Nairobi, Kenya		12. - 14.03.2024
Plastics & Rubber Vietnam	Ho Chi Minh City, Vietnam		13. - 15.03.2024
Techtextil Frankfurt	Frankfurt, Germany		23. - 26.04.2024
Stretch & Shrink Film	Valencia, Spain		23. - 25.04.2024
Chinaplas	Shanghai, China		23. - 26.04.2024
NPE	Orlando, USA		06. - 10.05.2024
Plastpol	Kielce, Poland		21. - 24.05.2024