SML TECH REPORT

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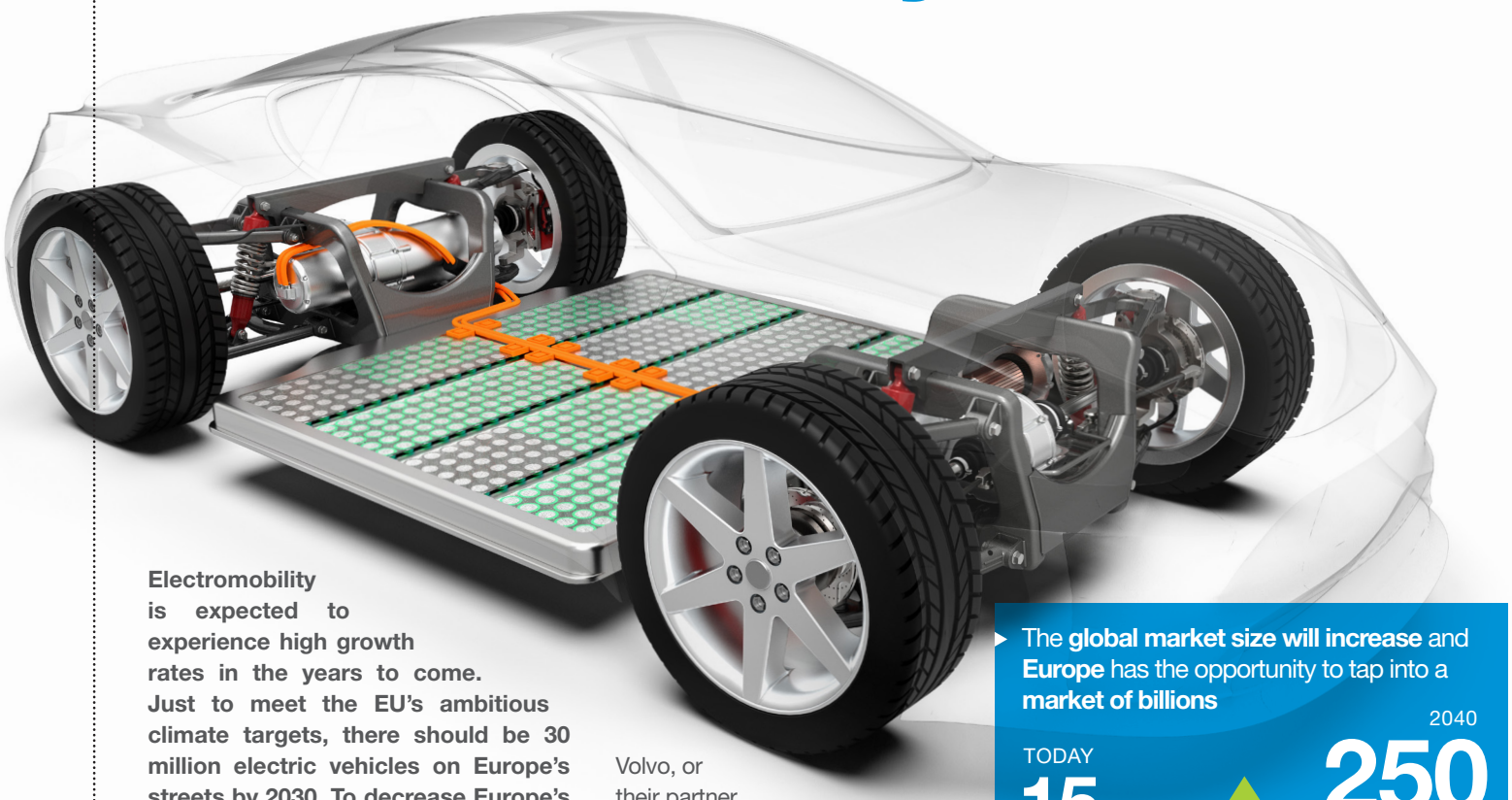
Separator film for lithium-ion batteries:

Ready for the expanding electromobility market?

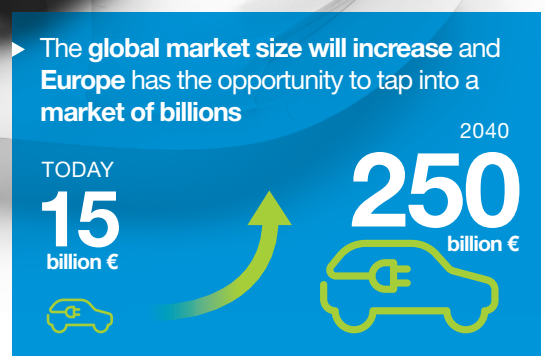


Electromobility is expected to experience high growth rates in the years to come. Just to meet the EU's ambitious climate targets, there should be 30 million electric vehicles on Europe's streets by 2030. To decrease Europe's dependency on imports, nearly every car manufacturer is currently working on solutions for battery production. In Europe alone, the annual demand for separator film for lithium-ion batteries (li-ion batteries) is estimated to be worth 10 billion euros as of 2025. This represents a tremendous new opportunity for manufacturers of technical cast film.

"The separator is an imperative key part in any lithium-ion battery, and SML's extrusion technology for manufacturing separator membranes for li-ion batteries is already market-proven", Alexander Bruckmüller, Product Manager at SML, comments. For ten years, SML has been delivering special extrusion lines for the production of high-end separator film in the dry process to leading manufacturers in Asia.

EXPANDING MARKETS FOR BATTERY COMPONENTS IN EUROPE

According to the "European Battery Alliance", an industry cooperation platform initiated by the European Union, batteries for seven to eight million electric vehicles should be manufactured in the EU by 2025 each year. In Europe the annual market demand for new batteries will be worth around 250 billion euros. In this context, an "innovative, competitive and sustainable battery value chain", that includes battery components, is to be set up in Europe. And the ambitious plans of the EU look as if they are about to become a reality: In recent months, several European carmakers such as Stellantis (PSA), Daimler, VW, BMW and Volvo, or their partner companies, either announced plans for opening of new battery plants or already commenced production.



OPPORTUNITY FOR MANUFACTURERS OF TECHNICAL CAST FILM

"The increasing demand for battery components can be a considerable opportunity for manufacturers of technical cast films, as the separator makes up 4 to 5 percent of the production costs of a lithium-ion battery. If the total market volume for complete li-ion batteries in Europe is estimated at 250 billion euros per annum, annual demand of up to 10 billion euros for separator film is realistic. And the demand for battery components is rapidly growing", Alexander Bruckmüller explains.

DRY PRODUCTION PROCESS: MARKET-PROVEN SML TECHNOLOGY

The separator in a lithium-ion battery is a special membrane, that separates the anode and the cathode inside the battery. It prevents short circuits and simultaneously guarantees the free transmission of lithium ions. Therefore, the fundamental properties of separator film are a porosity of more than 40 percent and a uniform pore size. Apart from that, high-end separator film must have excellent qualities concerning chemical and thermal stability, tensile strength and low shrinkage. To attain these properties, SML delivers extrusion lines which work on a dry process basis. Compared to separators produced in a wet process, the pore structure is more open and consistent. For that reason, films manufactured in a dry process are more suited to higher power densities. No solvents are necessary, to excavate the low-molecular material. The separator film leaving SML's cast film line can be a one or three layer film on a PP or PE-base. "We developed our lines for manufacturing separator film especially for Asian customers 10 years ago and have continued to develop them since then. Using a 100 percent reliable and market tested extrusion technology in a highly dynamic, fast growing market can be a tremendous business opportunity, especially for manufacturers who are already in the business for technical cast films", Alexander Bruckmüller concludes.

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Editorial

Karl Stöger
Managing Director

Dear Reader!

As we approach the end of the year, I will use the following lines to reflect, briefly, on 2021 before I turn my focus to the future and to what I foresee for our industry in the New Year 2022. Of course, everything is from the perspective of a machine builder, like SML.

Last year was full of surprises. In the early months of the year, we proceeded with our business plans with caution caught in the uncertainties of the ongoing pandemic and the prevailing, and rather insincere debates, about plastic harming the planet. Soon it became obvious, however, that these worries were defeasible and our expectations too conservative. Investments in extrusion lines continued to rise throughout the year. And finally, at the end of the year we can conclude that 2021 has, in actual fact, turned out to be one of the best years ever for our industry in general and for SML as a company.

Looking to the future, further surprises cannot be ruled out either. I am, however, optimistic that the appreciation for appropriate packaging will continue to grow. The environmental sustainability discussions are becoming more fact-based and, as this happens, it is becoming very clear that plastic film and sheet really do outperform other materials in many applications. As combined efforts in the industry towards a circular economy are stepping up, new technologies will offer new opportunities.

All of this sounds very optimistic, so what then are the surprises for 2022? In my view, the biggest restriction will come from imminent supply shortages. SML, as well as many of the comparable competitors of SML, is entering the New Year with a huge order backlog. Capacities cannot be doubled in the short-term for two main reasons.

First and foremost: People. Qualified professionals are already working to capacity and it takes time and patience to hire and train more skilled personnel. Second: Supply chain performance. The shortness of supply and delivery problems may cause further limitations in 2022. It is not only the well-known semi-conductor shortage. Many of the European sub-suppliers for bought-in machine parts are already reaching their capacity limits resulting in prolonged lead times.

Notwithstanding what I said before, I remain very optimistic about the New Year and the future development of our industry. Hopefully our readers will stay in a similarly upbeat mood.

Inside this Tech Report we broach various topics across our product range. Enjoy browsing through for articles which will, hopefully, trigger your interest.

I wish you all the very best for the New Year 2022

Trim management at stretch film production –

What is the best solution?

Every manufacturer can choose his 'right solution' without compromising the film quality

Customer requirements with regard to production flexibility and consistent film quality are increasingly gaining importance in stretch film production. These demands often raise the question about the optimum trim handling system. To find the best solutions to recover edge trims and bleed trims, SML has conducted long-term trials on its SmartCast® Infinity stretch film line. The trials were focused on ultimate, puncture and tear propagation – and delivered remarkable results.

"For trim handling and refeeding in stretch film production, there are two main options," Thomas Rauscher, Product Manager at SML, explains: 1) grinding in a mill and refeeding of fluff and 2) re-granulating in a recycling unit and refeeding of pellets. For the trials, SML added a third test series with no trim refeeding at all. This is not considered as a solution for commercial production, but it helped to get a better overall comparison.

QUALITY VS. EFFICIENCY

For most stretch film manufacturers, the key question is: "What is the best solution with regard to film quality?" Up to now, it was generally believed that no trim at all would be the best but most expensive solution. This was followed by fluff refeeding, and re-pelletising as the solution with the highest impact on film quality. No trim means that there is no influence on the quality of the film via the trim, and thus the maximum potential of the virgin raw material can be utilised. Fluff refeeding via a grinder happens fully automatically and uses less energy, while using a re-pelletising unit means a high flexibility in terms of the edge trim size, volume and trim refeed time.

CHANGED TECHNICAL PRECONDITIONS?

"Our initial question when starting our trials was whether these general assumptions were still valid with regard to the technical progress in that area," SML product manager Thomas Rauscher explains. The trials were conducted on a production-scale SmartCast® Infinity line which was equipped with both trim re-processing systems: fluff refeeding via a grinder and an extrusion re-pelletising unit. The change-over from one system to the other can be achieved in a couple of minutes. Processing with no trim at all was, of course, also possible on that line. For the trials, two types of products with two different thicknesses were manufactured on each system, which finally led to 12 different products. Each of them was investigated for 48 hours.

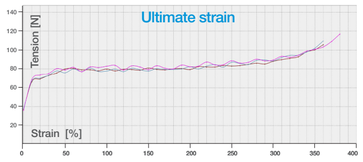
100 % COMPARABILITY

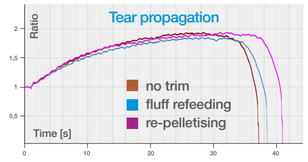
Every six hours, samples have been extracted, measured and analysed, with a focus on the three major parameters: "Ultimate", "Puncture" and "Tear Propagation". "It is important to mention that we run every trial at 100 % the same conditions, especially with regard to the melt filtration. In the past, melt filtration had to be frequently increased at the refeeding of fluff or re-pelletised material. On our SmartCast® Infinity we just used 100 mesh filters for all of the tests, which is quite low in this area and a very important aspect with regard to the results we have achieved!" SML product manager, Thomas Rauscher, explains.

KEY RESULT: ALMOST SIMILAR QUALITY AT ALL THREE SOLUTIONS

The key finding of the test-series is that all three solutions show very similar results on SML's SmartCast® Infinity line: The difference between the options with regard to the parameter "Ultimate" was less than 3 %. Also with regard to the parameter "Tear Propagation", the variation was only 5 %, while "Puncture Resistance" is in the same range as well at approx. 3,5 %. "As a conclusion we are able to answer: There is not any significant difference between the three options. Therefore, nowadays every manufacturer can choose his 'right solution' without compromising the film quality," Thomas Rauscher concludes.

	Ultimate strain [%]	tear time [s]	puncture force [N]
no trim	360	36,6	40,7
fluff refeeding	360	37,9	38,4
re-pelletising	380	40,5	40,9
average	367	38,3	40,0
standard deviation [%]	3,1	5,1	3,4





bitWise Upgrade:

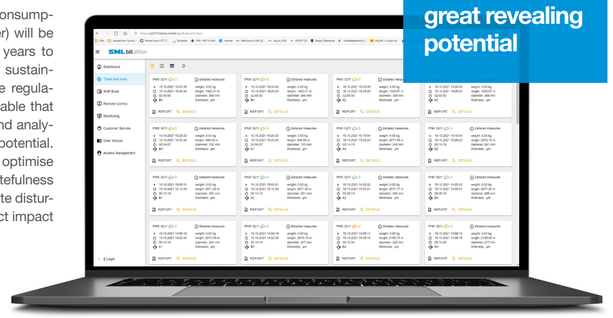
SML boosts data analysis

SML is currently installing an upgrade of its data analysis tool bit*Wise* on existing extrusion lines. Apart from optical and contextual enhancements, there are direct improvements in the following areas:

- cyber-security, user management and access rights,
- enhanced and more reliable capturing of OPC-UA related machine data from programmable logic controllers (PLCs),
- an enhanced reporting module,
- enhanced monitoring, and
- the integration of camera streams to monitor selected areas of extrusion lines directly at the front end.

The optimisation of resource consumption (raw materials, energy, water) will be of increasing importance in the years to come, above all due to imposed sustainability goals and more restrictive regulations. In this sense, it is indisputable that observation and the collection and analysis of data have a great revealing potential. Providing intelligent solutions to optimise decision making, to avoid wastefulness and to quickly detect and eliminate disturbances are already having a direct impact on operational costs.

Observation, collection and analysis of data have a great revealing potential



New Human-Machine Interface

Effective human-machine communication is essential for efficient production processes and product qualities. SML is replacing "classical" display-concepts in machine control step by step with web-based technologies. The possibility to visualise manufacturing processes on different devices, like smartphones or PC-screens, is a key feature of SML's new interface.

"Location-independency, flexibility with regard to different display sizes, a clearly structured and intuitive design and fast access options on all processes are fundamental requirements for any modern and effective human-machine interface (HMI)," Bernhard Harringer, Team Leader Software & Automation, elaborates. "More than ever before, the operator has a comprehensive tool at his disposal to control the actual state of the machinery and to react quickly and flexibly to deviations in the production process," Harringer comments.

SML's in-house developed HMI is based on a client-server architecture: different user groups have access to visualised and individualised screen content, without directly interfering in SML's machine control. Data management is based on OPC UA, which is increasingly common at all levels of communication as a future bus system – from fieldbuses to factory automation. This universal approach to data retention facilitates the integration of a third-party system into the new visualisation concept.

Designed for recycling:

Expanding market for mono-material applications

Demand for MOPE, MOPP and MOPET film has been rising sharply during the last two years. The main reasons for this phenomenon are the better recyclability and the lighter weight of the packaging materials. SML's further-developed MDO unit for cast film is the ideal technology for manufacturing these types of film.

"Mono-material stand-up pouches that are easy to recycle are an excellent example of the innovative potential of MDO film," Alexander Bruckmüller, Product Manager at SML, explains. Stand-up pouches usually consist of two different materials: a relatively stiff BOPP or BOPET film, which is frequently printed, and a thicker sealing layer made of PE. Due to this composite structure, the recycling of these stand-up pouches is relatively demanding.

MONO-MATERIAL PACKAGING

"To replace BOPP or BOPET film at stand-up pouches, our customers manufacture MOPE film with a thickness of 25 to 30µm. This film is perfect for mono-material pouches, which can be easily recycled in existing facilities without preceding material separation processes," Alexander Bruckmüller comments.

New types of carrying handles from monoaxially stretched MOPE for plastic bags are another example to simplify the recycling of PE packaging: together with the plastic bags, the carrying handles can be re-processed in one and the same step.

ULTRA-THIN BARRIER FILM FOR MONO-MATERIAL SOLUTIONS

An easy to recycle barrier film is another exceptional product manufactured on SML's MDO units: In the MDO process, the oxygen barrier properties of the EVOH layer are improved while its thickness is diminished. As structures with no more than 5 % of different materials are classified as mono-material, these types of EVOH barrier film are known to be easy to recycle.

In addition to films especially developed for the circular economy, SML's cast film lines with MDO units manufacture materials for a wide range of further applications: Thicker MOPP film (50 – 80µm) for the inner layer of stand-up pouches facilitates the straight tear-opening.

Monoaxially stretched MOPET films are used for adhesive tapes and for the lamination of tinplate cans. And twist wrap film manufactured in an MDO process, has ideal properties for subsequent metallisation and printing.

STABLE PRODUCTION – WIDER LINES - HIGHER OUTPUT

The design of SML's last MDO generation allows bigger roll diameters, which makes the rolls stiffer and stabilises film pass. "This is an important prerequisite for the construction of our bigger lines with final film widths up to 2,800mm," Alexander Bruckmüller explains. The bigger roll diameters also facilitate the longer contact times of the film on the rolls and improve the through-heating of the film. This also contributes to the stability of the process.

TIGHT THICKNESS TOLERANCE

Before the MDO process, there is an optimum film flatness, as the primer film is cooled very evenly on SML's chill rolls. The exact regulation of the chill roll temperatures also has positive effects on the MDO processes, especially in terms of crystallisation and film transparency. MDO film manufactured on SML's cast film lines has a very good thickness tolerance. The reason for this is that thickness control and regulation take place after the film has passed the MDO unit and the thickness difference at the neck-in of the primery film is taken into account.

SML's last generation of MDO unit can practically upgrade any cast film line. Compared with lines for blown film, cast film lines generally score with higher production speeds and higher output volumes.

Mono-material stand-up pouches are easy to recycle and an excellent example of the innovative potential of MDO film

Expanding product portfolio

What's next at Austrofil spinning lines?

Julian Bammer is the driving force behind the development and advancement of SML's Austrofil® multifilament spinning lines. TechReport talked to the product manager about what has been accomplished in the field of high tenacity (HT) multifilament spinning, growth plans in the direction of PET and PA6 yarns and why he enjoys working at SML.

Julian, how would you rate SML's current position in the spinning machinery market?
SML is traditionally strong at spinning plants for the production of high tenacity yarns, and demand continues to be high for our tried and tested HT plants. This year the sales figures for our best-selling HT model reached a record mark. And also the sales figures of POY (pre-oriented yarn) and MDY (medium drawn yarn) lines are satisfactory. The development of demand for our bulk continuous filament (BCF) plants, that are mainly used in the carpet industry, is similarly gratifying.

What constitutes SML's success in HT multifilament spinning lines?
One important reason for our success in this field is our line's output efficiency. Another one is our production flexibility. Our HT lines are used for a very wide range of different applications where a superior tenacity is required, for instance ropes, belts or nets. However, we do not intend to just bask in this success, we want to develop the product group further and continue to expand.

Tell us more about that. What are the recent developments?
Up to now, we had a clear focus on processing PP. One of our current priorities is to market our newly designed plants, that process materials other than PP as well, namely PET and PA6.

The market for PET yarn is huge. Which area are you embarking on first?
In general, we can divide the market for PET yarn into two segments: one for lower titre ranges and another for higher titre ranges. Our spinning technology for PP yarn is clearly focused on higher titre ranges. In that area, we have profound expertise. For that reason, we first launched machinery for PET medium and high tenacity yarn production in a range between 250 and 700 den. SML has already supplied a POY version for yarn tenacities of around 2.5 g/den and a MDY version for medium tenacities from 3.5 to 4.5 g/den.

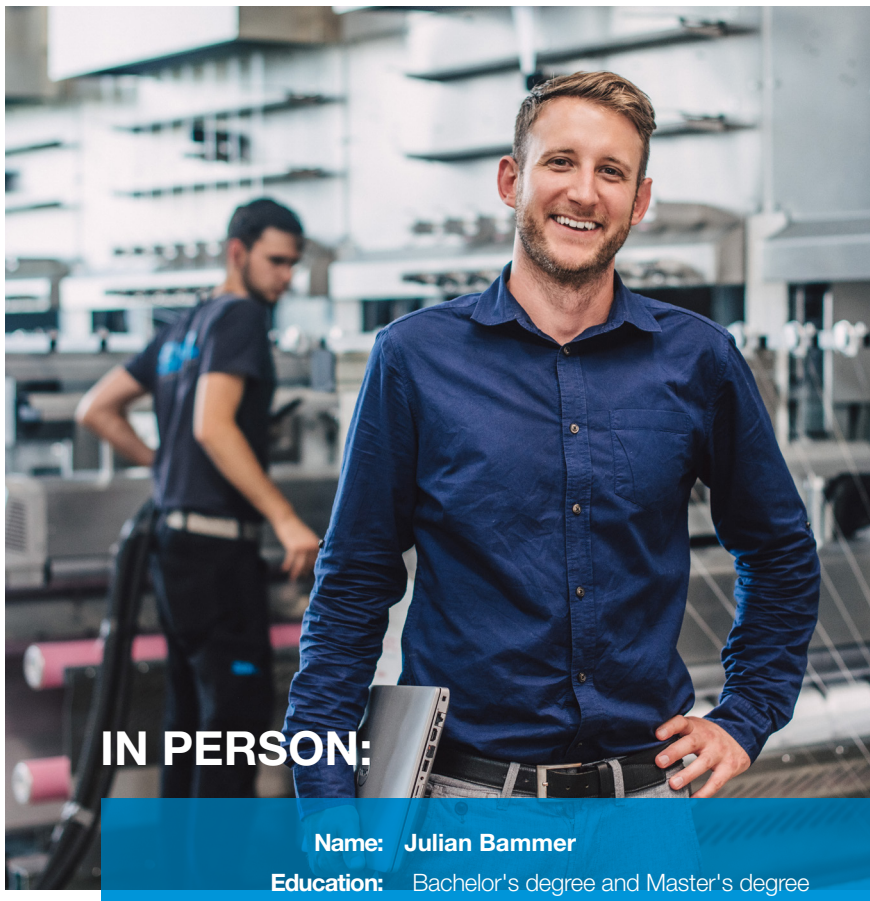
And what are your current activities in the field of PA?
Based on joint trials with one of our customers, we have recently designed a HT plant that is able to process both PP and PA6. Compared with PP, yarn from PA6 basically has a higher tenacity and it can be coloured after the spinning process, which extends its range of application. The smooth change-over from one raw material to the other underlines the high production flexibility of this type of new HT line. Currently, our new line for PP and PA6 yarn is set-up at one of our customer's sites in the European Union.

How important are line efficiency and the production costs?
Very important!! We have been constantly further developing our lines towards less energy consumption and higher output capacities. This is important to operate a line economically.

What comes next in the area of PP spinning?
A huge benefit of our market-approved plants for PP is the tremendous production flexibility. However, this high flexibility sometimes affects the output volumes in lower titre ranges. To overcome this, we have now developed a PP plant especially with a focus on the production range between 150 and 500 den, mainly for medium tenacity yarns.

What is the difference to SML's proven HT lines for PP?
While our proven HT lines are configurable for a maximum number of 16 yarns, the new machine concept allows the simultaneous production of 24 yarns without hydraulic splitting, which means it is equipped with 24 spinpacks. This solution makes the production of higher volumes of PP yarns with a medium tenacity extremely efficient. The first new plant of this type has been delivered to a customer in a CIS country.

And finally a personal question: You studied Development Engineering with a focus on computation and simulation. What fascinates you about your task as Product Manager for SML Spinning Lines?
My technical studies help me substantially with the development of new spinning technologies, processes and ultimate products. Nevertheless, after I had finished university, it soon became clear to me that I would not spend my whole working life just sitting in front of a computer and making relatively abstract simulations. At SML I enjoy the diversity of my tasks: Developing new technologies and interacting daily with interesting and ambitious people all over the world – like our customers and suppliers – are what make this job so appealing.



IN PERSON:

Name:	**Julian Bammer**
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Personal interests:	Travelling, sports, freestyle-cooking
I describe myself as:	Communicative and open-minded towards people and cultures

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Aseptic packaging:

New extrusion laminating lines for Africa and Europe

SML's division for coating and lamination has booked another two orders from reputed European and African manufacturers for extrusion laminating lines for aseptic packaging materials.

"Aseptic carton packages for liquid dairy products, non-carbonated soft drinks and for other food products are easy to produce, to fill and to transport," Mario Höllnsteiner, Product Manager at SML, explains. They consist mainly of paper board from renewable resources and have a space saving design. "Due to the ongoing development of eco-friendlier, easy-to-recycle material combinations, we face a worldwide trend towards investments into sophisticated extrusion laminating machines for aseptic packaging," Mario Höllnsteiner, Product Manager at SML, comments. SML's Triplex extrusion laminating lines are equipped with three coating stations in series, where the cardboard is laminated with different layers of polyolefins and ultra-thin aluminum foil. In some structures, the aluminum can be replaced with alternative co-extruded barrier layers. The two new lines for aseptic packaging materials will start operation at the customers' sites in the course of 2022.

Events 2022

Due to the current situation we keep you up to date at **www.sml.at**

Extrusion lines – engineered to perform

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