

# TECHNOLOGY report

## SML

EXTRUSION LINES – ENGINEERED TO PERFORM ▶

LENZING | AUSTRIA edition no. 17 1/11



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EDITORIAL



**Karl STÖGER**  
Managing Director

Dear Reader,

When considering the main topics in this TR, you may well get the impression that SML's focal point has shifted towards high-tech applications. Indeed, we are becoming increasingly involved in application-oriented development work for sophisticated products. Customers with innovative projects come to SML because we are in an ideal position to turn their visions into reality. Our team of technicians, process engineers and research scientists is able to implement complex projects in an efficient manner. Moreover, for material and product trials, the manifold capabilities of our in-house laboratory lines help to translate ideas into action in the shortest possible time.

Having said all this, I do not want to leave you with the feeling that SML is neglecting standard products. We still deploy a lot of our resources to further develop stretch film technology and thus consolidate our leading position in this area. In fact, in terms of business volume, cast film extrusion lines, which apart from stretch film also include CPP, barrier and hygienic film lines, constitute SML's fast-est growing product group. It should also be added that the EcoCompact line concept, which was premiered at the K 2010, has met with an extremely positive response in the market and it has quickly become the top benchmark for quality and efficiency.

Our sheet extrusion lines are also on a similarly successful growth course. PET sheet leads the way, but standardized PP and PS sheet lines demonstrate equally excellent performance. You may rest assured that we are sparing no effort to promote and further develop these standardized machines. This is vital, as without mastery of the market base it would be very difficult for us to reach the top segment, especially in view of the fact that many of our sophisticated machines for high-end applications are configured upgrades from our standard equipment range.

Yours sincerely

## Revolutionary extruder concept ahead!

Imagine that you had a free wish from a fairy godmother with regard to your existing extruder. What would you choose? A lower melt temperature? More output with the same machine size? Less energy consumption? Faster material change? A multipolymer screw? A wide output range with no restrictions?

Well, although this sounds like a fairy tale, we actually think that we have found a solution that answers all these wishes at one go. The machine in question is called the HO-LT, which stands for **High Output and Low Temperature** of the melt.

Due to the revolutionary design of the entire screw in combination with a new barrel feed section, it is possible to improve the plastification process significantly (patents pending). The key is a controlled pressure profile along the screw, which offers the benefits of energy efficient plastification at a very high output level and outstanding process stability. As compared to a conventional smooth bore extruder, the output of the screw is especially linear and this results in an extremely stable and low



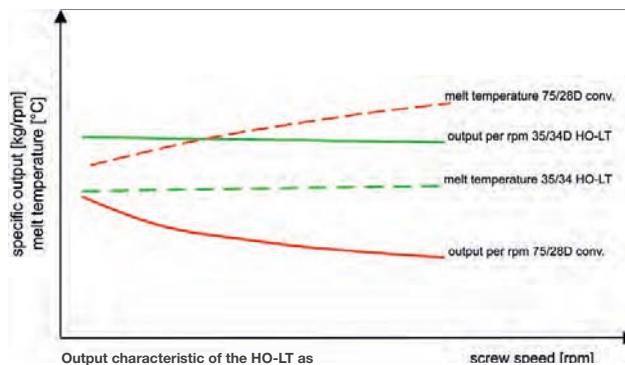
**HO-LT**  
Extruder D35/34 HO-LT

melt temperature. Moreover, thanks to its special pressure profile, the screw can handle both high and low die pressure, with remarkably little effect on output and melt temperature.

We have subjected the first extruder, which has a 35mm screw, to six months of in-

Performance Comparison		D35/34 HOLT	D75/28 conventional extruder
Output range EVOH	[kg/h]	5-120	40-90
Free volume of screw	[cm <sup>3</sup> ]	542	2935
Melt temperature*)	[°C]	215	225-230
Screw speed*)	[rpm]	250	70
Average residence time*)	[s]	18	100
Energy consumption*)	[Wh/kg]	190-200	250

\*) at output of 90 kg/h EVOH



Output characteristic of the HO-LT as compared to a conventional smooth bore extruder

tensive testing with a wide range of materials. The result is that 95 per cent of all the materials tested run perfectly with only one screw geometry. An example of the potential of the HO-LT system over a conventional extruder can be seen in above comparison table.

Apart from the 35mm HO-LT, we also have other dimensions in the experimental phase. Please contact our sales or technical departments for more details [drb@sml.at](mailto:drb@sml.at)

Berthold DRÖGE, Technical Director  
Wolfgang BINDER, Product Manager Extrusion

# SML laboratory line – the innovation center

Sleeve-touch technology has advanced tremendously since we started with our first line some 10 years ago. Therefore, in order to cope with new developments, it was necessary to establish a completely new and more multi-functional laboratory line. The sleeve-touch module remains a key element in the new lab line, but a range of new modules for alternative production processes has been added.

Moreover, easily exchangeable modules for sheet forming, film casting and extrusion coating processes are now available for applications not requiring the superior optical properties of the sleeve-touch process.

The line is designed for maximum flexibility and is able to run a wide range of polymers. Dryers for the dehumidification of hygroscopic raw materials, three extruders in different sizes, including a HO-LT extruder, a 5-layer feedblock and an automatic die with quick gap adjustment have all been installed. The horizontal roll stack with exchangeable rolls of different surface structures offers process temperatures of up to 160°C.



SML laboratory line

And in addition, one unwinding station upstream for substrates, two unwinding stations downstream for protection film and an automatic winder allow the production of a wide variety of films and laminates.

Interested companies can hire the complete line, including our experienced operators, on a daily or weekly basis. We welcome everyone, who is looking for new ideas in film and sheet production, wants to test new raw

materials, or is seeking to verify the concept for a new production line. Incidentally, our line is not on a laboratory scale, but in fact has a roll width of 1050mm and can produce up to 500 kg/hour.

Should you wish to find out how your product development can benefit from this laboratory facility, please do not hesitate to contact us at: [kam@sml.at](mailto:kam@sml.at).

**Martin KALTENECKER,**  
Head of Sales Department

## SML Machine for conductive polycarbonate carrier tapes

Allied Speciality Compounds Pte Ltd (ASC) from Malaysia is to install an SML coextrusion calendaring line for the production of thin polycarbonate (PC) films for carrier tapes. The line will be equipped with a 3-layer multi manifold die.

Conductive carrier tapes are used for the packaging of electronic components such as bare chips, resistors, inductors, etc. ASC is an established player in this market and has its own in-house compounding technology and various proprietary formulations for the electronic industry. SML was selected after the completion of convincing trials using our pilot plant. Moreover, our experience with the extrusion of polycarbonate and the flexibility of the SML roll stack were of primary importance to ASC's purchase decision.

### EXTRUDER CONDUCTIVE FILM



Source: ASC homepage ([www.ascpl.com](http://www.ascpl.com))

# A modular solution for extrusion coating

Companies offering extrusion coating services have to handle a wide variety of products and need to have customizable equipment in case of market shifts. Their products can differ in terms of

substrate types, product width, coating material, extrusion polymer, structure, etc. The challenge is that they want to run all these items on the same line and to achieve top quality with a minimum

of waste and short transition times between products. As a consequence, machine manufacturers are faced with the daunting task of making this balancing act possible.



Line in production at SML premises

SML's latest development to meet these customer requirements is an extrusion coating and laminating concept, which can handle a multitude of diverse products. This involves a multi-purpose line that is equally suitable for tension-sensitive light-weight materials as well as heavy and stiff substrates.

The key to this achievement is the modular design of the single processing modules in combination with a super-ordinated control system. All units such as the unwinds, coating unit, extruder carriage, winders, etc. are designed and built as functional modules.

For example, the EcoFlex series unwinds can handle shaftless substrate rolls with a maximum diameter of 1,500mm in both unwinding directions. Moreover, due to the separately driven chucking arms, different material widths can be processed. Light-weight carbon fibre dancer equipment allows the exact tension control of sensitive materials such as nonwovens and even 7µm aluminium foil can be handled by the same unwind using a constant gap module. Furthermore, in combination with a pull roll module at the outlet of the unwind, materials requiring higher web tensions (paper, rigid film, etc.) can also be employed.

The complete extrusion coating line is available in this modular design concept. In the control system, the adjustable parameters of each unit are stored separately in a common recipe for every product produced. For the operator, this minimizes and simplifies adjustments during product changeovers, thus providing maximum line versatility and improved uptimes.

**Mario HÖLLNSTEINER,** Product Manager  
Extrusion Coating and Laminating

# Optical PC film for LCD modules

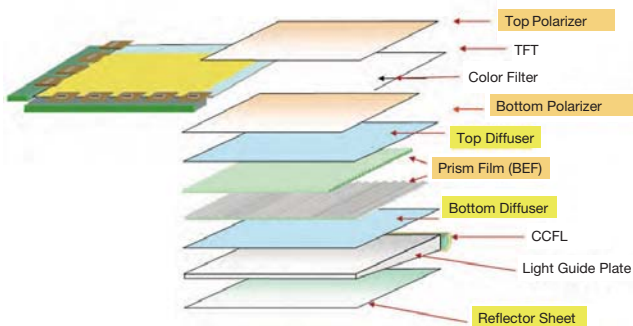
Chi Lin Technology Co. Ltd has imported a 3-layer polycarbonate (PC) calendering line from SML. Chi Lin belongs to the Chi Mei Group, a leading manufacturer of LCD modules in Taiwan, which mainly serves television manufacturers in South Korea and Japan. The line was designed together with the

customer in order to fulfil the special requirements for a variety of films, which are currently used in LCD modules. One application is a matt PC film (diffuser film) with various structures - prism and polarizer films can also be produced. These are fabricated with highly polished rollers and afterwards coated

with additional layers in further steps, in order to fulfil their optical function.

Included in the delivery is our latest generation of roll stack for optical films, which combines SML proprietary Smart Parallel Gap (SPG) technology and advanced drive engineering for polishing rollers. An SML W2000 horizontal sliding winder is also employed, which is especially suitable for such applications and has already been included in installations for similar types of films at other customer plants.

General TFT-LCD Structure



Source: Display Search

Roland HÖRLESBERGER,  
Product Manager, Sheet  
Extrusion



Winder 2000



# One stop-shop for photovoltaic film and sheet extrusion lines

Due to the fast growing demand for alternative energy sources, SML has developed turnkey film and sheet extrusion systems for the solar panel industry and has an inhouse pilot plant available for product and recipe development. The extensive experience gained through exhaustive testing on this in-house pilot plant has helped SML to sell industrial size reference plants for all the main film components in a solar panel, i.e. the frontsheet, the encapsulant film and the backsheet.

In modern photovoltaic panels, the solar cells are sandwiched by the encapsulant film, while a laminated backsheet is required to insulate and protect the bottom side of the panel. A special ETFE sheet can replace the glass on the front side of the panel.

Encapsulant films provide the gentle embedding of the solar cells and also the necessary adhesion to the front-

and backsheet. An ingenious film production and stabilization process is used to achieve high dimensional stability of the encapsulant film at high temperatures. Other important film properties such as a shorter curing time in the autoclave are controlled by the formulation of the raw material rather than during the production process itself.

Backsheet films are usually produced in bright colours in order to optimize the reflection of the impacting sun radiation efficiently. The films can be laminated onto a functional backsheet structure in order to provide the necessary hydrogen and oxygen barrier and to protect the complete inside of the solar panel from any possible environmental influences. Moreover, as electricity is generated inside a solar panel, the backsheet must also be a good electrical insulator.

In flexible solar panels, an ETFE front sheet is used instead of glass. It is very

important to minimize any negative environmental influences, such as moss growth, yellowing or brittleness. Furthermore, this sheet has to allow the permeation of as much incident radiation as possible.

All the films supplied to the photovoltaic industry have to be engineered for a prolonged service life and a minimum of 20 years must be guaranteed. Neither the perfect optical quality, nor the functional properties may deteriorate beyond a certain limit or within a defined period.

As it possesses the know-how required for all the main ex-

truded components in a solar panel, SML can justifiably claim to be a "one-stop-shop" for photovoltaic film and sheet making equipment.

Rupert BECKER,  
Product Manager, Sheet Extrusion



# Double energy savings through a high-speed extruder with fluff refeeding

SML's approach to the supply of reliable and energy-efficient extrusion equipment has moved up a level through the combination of traditional edge trim handling using fluff refeeding with new generation HSE 90/33 high-speed extruder technology.

Until recently, it was almost impossible to feed back the reground edge trim to an extruder with a diameter of less than

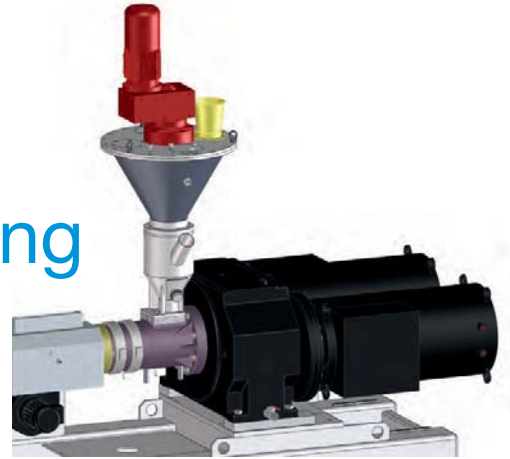
120mm. The low bulk density of the fluff material simply required more volume in the feeding zone of the extruder screw than a smaller diameter could provide. Therefore, repelletizing units were installed for the refeeding of edge trim flakes into extruder sizes smaller than 120mm. SML has now succeeded in developing an advanced screw-scrapertruder combination for stretch film lines, which allows the feeding back of flakes from reground edge- and bleed trims directly into a 90mm diameter, high-speed extruder. This new method of recovering the edge- and bleed trims reduces the

investment costs of the complete stretch film line, as well as the energy consumption needed for edge trim handling. The SML system for the regrinding and refeeding of flakes via the scrap truder consumes about 50 per cent less electricity than a system with a repelletizing machine.

In fact, this combination of the recognized energy savings provided by the IR-heated high-speed extruder and the

halving of the electricity requirement for trim recovery achieved by the new scraptruder, sets a fresh benchmark for energy efficient stretch film production. This new technology is available for the EcoCompact concept, as well as for all standard SML stretch film lines.

**Thomas RAUSCHER, Product Manager**  
Cast Film Extrusion and MDO



## Borouge invests in the future

Borouge, one of the Middle East's leading polyolefin resin suppliers, has ordered an SML cast film line for its new Abu Dhabi Innovation Centre. The line will be equipped with three extruders and a 5-layer feedblock. The final film width is 700mm at a maximum production speed of 350m/min. Borouge will utilize this new laboratory cast film line for raw material testing and to support new developments. Borouge is a joint venture of the Abu Dhabi National Oil Company and the European Borealis Group.

# PET news for converters

SML has recently completed intensive research in the field of PET cast film and PET MDO film, which has resulted in significant improvements in the converting behaviour of thin PET films.

Targeted applications are:

- **PET twistable film for candy wrapping**  
We have tested several PET formulations in a thickness range from 20-30µm. A wrapping test using Theegarten-Pactec twisting machines provided positive results at a speed of 1500-1800 wrapped candies per minute.
- **PET lamination film for converting**  
This special, contingently, mono-axially oriented PET film in the 15 -60µm thickness range is used for food

packaging and can also be printed and laminated. From the perspective of converters, as opposed to CPP films, casted PET films offer significant advantages. They exhibit excellent transparency and allow higher heat seal strength at lower sealing temperatures. Higher surface wetting tension, which also shows less decay over time, makes printing easy. Moreover, and most importantly, SML has found a way to positively influence heat shrinkage and impact strength thus making the film suitable for diverse lamination and converting processes.

- **PET lamination film onto metal sheet**  
PET film can be laminated onto metal sheet as corrosion protection. For



example, in beverage tins, the thin PET film serves as an ideal barrier layer, thus preventing direct contact of the beverage with the metal sheet and preserving the taste and aroma of the filled drink.

**Alexander BRUCKMÜLLER, Product Manager**  
Cast Film Extrusion and MDO

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## EVENTS 2011

EVENT	LOCATION	BOOTH	DATE
STRETCH & SHRINK FILM CONFERENCE	Vienna, Austria		April, 11 - 13
INDEX	Geneva, Switzerland	2280	April, 12 - 15
BRASILPLAST	Sao Paulo, Brazil		May, 9 - 13
INTERPACK	Düsseldorf, Germany	11/E55	May, 12 - 18
CHINAPLAS	Guangzhou, PR China	B61	May, 17 - 20
TECHTEXTIL	Frankfurt, Germany		May, 24 - 26
TIPREX	Bangkok, Thailand		Aug., 31 - Sept., 3
ITMA	Barcelona, Spain		Sept., 22 - 29

## IMPRINT

**Publisher: SML**  
Bundesstrasse 1a, A-4860 Lenzing  
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© Date: 26.03.2011  
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