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# Film and Sheet EXTRUSION

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# AI speeds development of soft plastic materials

Finnish research centre VTT has expanded the use of its physics-based modelling and AI - to model and design soft materials including polymers and plastics.

VTT's virtual modelling toolbox - ProperTune - had previously been used to model hard materials such as metals.

It allows companies to cut product development time in half, decrease cost elements of product development, reduce environmentally harmful materials and design new materials that perform better, says VTT.

"Developing products virtually is happening now," said Antti Puisto, research

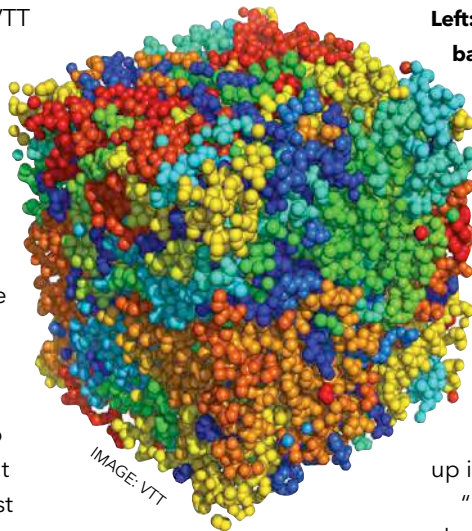


IMAGE: VTT

team leader at VTT. "As products are improved and new ones are created for different industries, we need to make each resource count."

He says the technique holds promise for the

**Left: VTT is using physics-based modelling to develop new plastic materials - such as this PLA**

construction industry, as an example. Here, insulation materials in the walls of buildings are typically made of petrochemical-based polymers or mineral wool - which often end up in landfill.

"How do we create an alternative insulation material that doesn't rot between the walls - but disappears without a trace after its life cycle is over?" he said. "This is the kind of inspiring challenge that we want to tackle."

➤ [www.vttresearch.com](http://www.vttresearch.com)

## ECJ rules on TiO<sub>2</sub> regulation

The European Court of Justice has ruled to annul parts of the European Commission's Delegated Regulation 2020/217 covering harmonised classification and labelling of TiO<sub>2</sub> as a carcinogenic substance by inhalation.

In its **judgement**, the court ruled that the requirement under existing EU law to base the classification of a carcinogenic substance on reliable and acceptable studies was not satisfied. It also ruled the Regulation infringed the criteria that classification of a substance as carcinogenic can only apply to a substance that has the intrinsic property to cause cancer.

## ECHA calls for PVC and additives evidence

The European Chemicals Agency (ECHA) has made a second call for evidence on PVC and additives.

In the call, ECHA is "requesting information on PVC and on the substances used in PVC selected for a closer scrutiny".

It is gathering information on uses, EU volumes per use sector and end-

use, end-of-life information per use and - if available - experimental or measured release and exposure information.

"With this call, we strive to obtain an understanding on the use volumes at the EU level per sector," said ECHA.

VinylPlus - the European PVC industry's scheme to raise sustainability - says it will provide information.

"We support a science-based investigation process and look forward to contributing to the ECHA report and working with ECHA and the European Commission within a science- and risk-based framework," it said.

Evidence can be **submitted to ECHA** by the deadline of 6 January 2023.

➤ [www.vinylplus.eu](http://www.vinylplus.eu)

## Huhtamaki posts strong results in Q3 2022

Packaging manufacturer Huhtamaki has posted strong results for the first nine months of 2022.

Sales for the period increased by 31% to nearly €3.4 billion (US\$3.5bn). Adjusted EBIT for the period

was €302 million (US\$317m). In Q3, sales rose 31% to nearly €1.2bn (US\$1.2bn) and adjusted EBIT by around 33% to €101m (US\$106m).

The largest rise was seen in flexible packaging, which

saw a 45% increase in sales for the first nine months, and a 48% increase for Q3 alone. These equated to profit increases of 49% and 55%, respectively.

In September, the company divested its

operations in Russia, which netted nearly €38m (US\$40m).

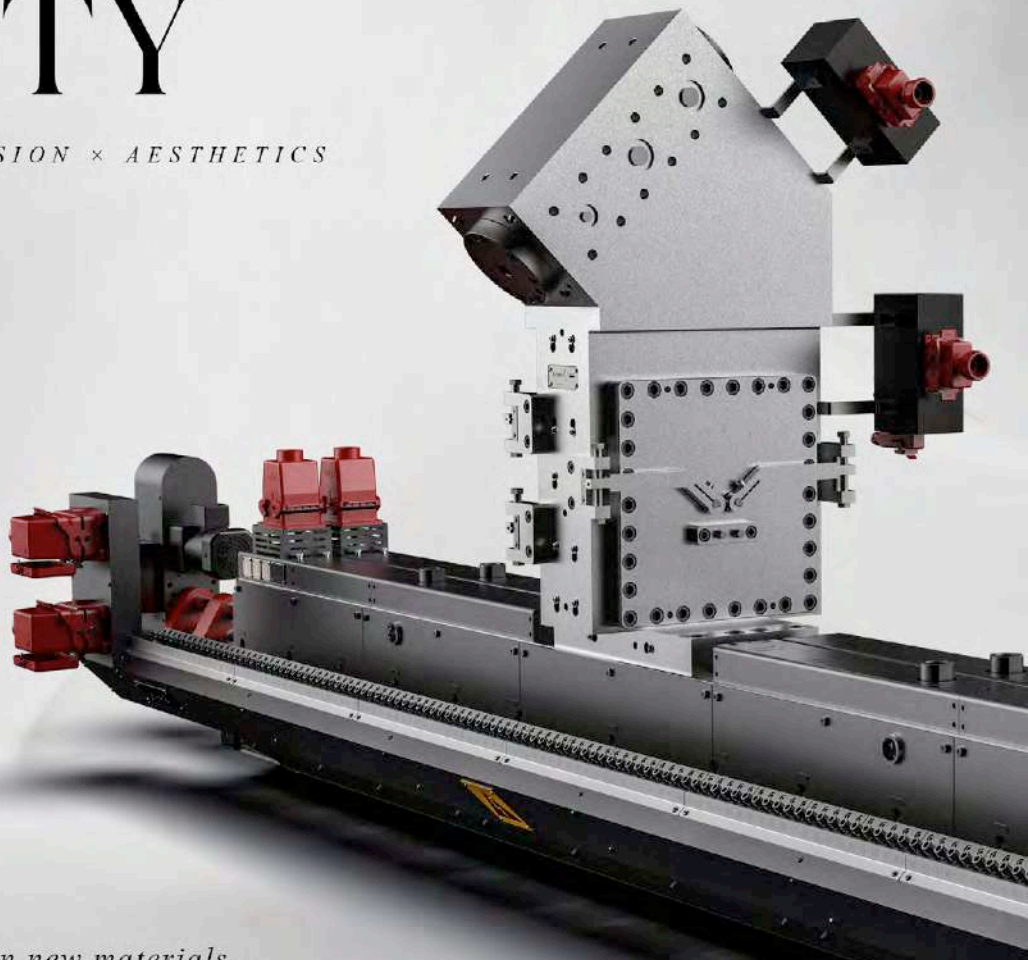
Huhtamaki expects 2022 results to be better than in 2021 - though with some "continued volatility".

➤ [www.huhtamaki.com](http://www.huhtamaki.com)

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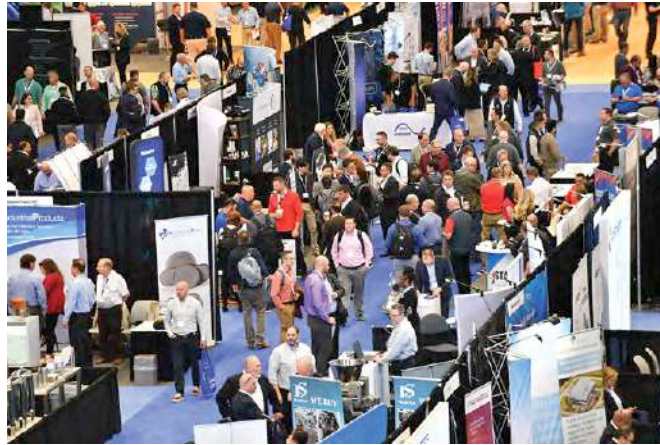
# AMI's Cleveland expos attract record numbers

The AMI Plastics World Expos - which took place in Cleveland, USA last month - attracted record numbers of exhibitors and visitors.

The event brought together four focused tradeshow - the Plastics Extrusion World, Compounding World, Plastics Recycling World and Polymer Testing World Expos.

"We were delighted to welcome over 300 exhibitors and more than 4,600 attendees to this year's exhibitions, representing year-on-year increases of 36% and 53% respectively," said Kelly DeFino, exhibition sales manager at AMI. "The numbers were also well ahead of our pre-pandemic launch expos in 2019."

Five conference theatres hosted more than 100 speakers and were a major attraction once again - with standing-room only for some talks and panel discussions. The evening networking party also proved popular, with more than 450 people attending the event at the Punch Bowl Social Cleveland.



**Above: AMI's co-located events were well attended - attracting more than 4,600 visitors**

Visitors welcomed the information exchange and collaboration that the expos encouraged.

Manfred Hackl, CEO of the Erema Group, appreciated the complementary nature of the focused expos, stating: "The combination of recycling, compounding, analytics and extrusion is the high value of the show."

Exhibitors were also positive about the size and quality of the audience. Slayton Altenburg, application specialist at TPEI, said: "The show is very well attended, and the quality of conversations has been

great." Christian Tittensor, director of sales and marketing at Zeppelin, added: "It's really important for people to attend these kinds of expos to get face-to-face. We've had a lot of success here."

And Jim Norris, market manager at Palmer Holland, commented: "Our audience is here. We find a tremendous reach at this expo."

The AMI Plastics World Expos will next take place in Essen, Germany on 14-15 June 2023. They return to Cleveland on 15-16 November 2023.

**> [www.ami.international/exhibitions](http://www.ami.international/exhibitions)**

## CKF buys rPET firm Packright

Scotia Investments portfolio company CKF has acquired thermoformed rPET rigid packaging supplier Packright, which is based in Langley in British Columbia (BC) in Canada.

The company will continue to operate in the market as Packright. At the same time, it has appointed Colin Chiu to be director of new market development for plastics.

CKF now operates five plants in Canada - including: Hantsport (Nova Scotia); Rexdale, Ontario; and Langley and Delta (both BC). In addition, it operates two plants in the US - in Clinton, Indiana and El Paso, Texas.

CKF said customers will have access to a wider product line, expanded production capacity from CKF's Delta plant and a vertically integrated supplier when CKF's extrusion facility in Rexdale, Canada, becomes operational in December 2022.

**> [www.ckfinc.com](http://www.ckfinc.com)**

## Tie-up will lead to new bio-based materials

Bioplastics producers NatureWorks and CJ Biomaterials have signed an agreement that will see them collaborate on the development of new sustainable materials.

While NatureWorks is a leading producer of polylactic acid (PLA), CJ Biomaterials produces polyhydroxyalkanoate (PHA).

The companies plan to develop materials to replace fossil-fuel based plastics in applications ranging from compostable food packaging to films and other products. The initial focus will be to develop bio-based solutions for compostable rigid and flexible food packaging.

"Plastic pollution is a major global

concern," said Seung-Jin Lee, head of biomaterials at CJ CheilJedang, the parent company of CJ Biomaterials. "To successfully address this, it is critical to introduce new solutions that will have a real impact by improving the biodegradability and compostability of plastic."

**> <https://www.cjbio.net>**

**> [www.natureworkslc.com](http://www.natureworkslc.com)**

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## Polykar has new facility

Polyethylene packaging company Polykar has opened a new 50,000 sq ft production plant in Canada.

The new facility - in Edmonton, Alberta - has immediately created 50 new jobs, which could rise as high as 70 within two years. It complements the company's Montreal facility and is designed to serve customers in Western Canada and parts of the US.

"The plant includes a cutting-edge recycling facility, positioning us to divert plastic waste from landfills," said Amir Karim, CEO of Polykar.

Production has already begun at the new plant, which will develop flexible and compostable packaging - and makes extensive use of robotics and automation, said Karim.

The company has also bought 1.5 acres of land just north of the plant - giving it the potential for further expansion in future.

> [www.polykar.com](http://www.polykar.com)

# North America machine sales rise in Q3 2022

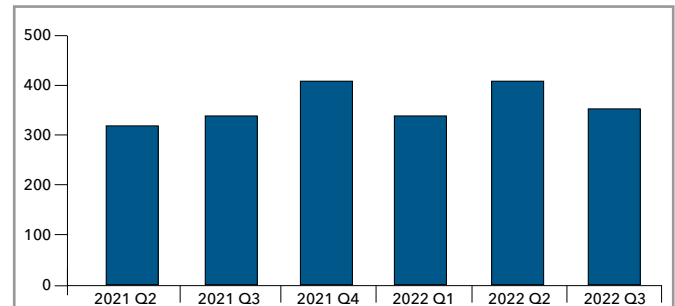
Sales of primary plastics machinery in North America rose in the third quarter of this year - in comparison with the same period in 2021.

The Plastics Industry Association estimated sales at US\$354 million in the period, a rise of more than 6% compared to Q3 2021, but around 14% lower than Q2 of this year.

In Q3 of this year, single-screw extruder sales rose by 5% compared to the previous quarter - but was 13% lower than Q2 2021. Sales of twin-screw extruders grew by 12% compared to the previous quarter, and by 19% compared to Q3 2021.

For comparison, sales of injection moulding machinery fell by around 17% in comparison with the previous quarter.

"It can be argued that the slowdown in plastics machinery shipments in Q3 is in sync with the cooling of the US economy," said Perc Pineda, chief economist at the association. "However, this year's third-quarter shipments remain above the



Primary plastics machinery sales, North America

Source: Plastics Industry Association, 2022

first three quarters' shipments last year."

There is also a year-end push for businesses to get their manufacturing capacity in gear for the coming year, he added.

"This should support stable demand for plastics equipment next year, albeit lower than this year because of moderating economic growth," he said.

Machinery exports fell 10% to US\$199m in Q3 2022, with Mexico and Canada remaining the top destinations. Exports to USMCA partners totalled US\$110m - nearly 66% of total US plastics machinery exports. Imports decreased by 12% to US\$424m in the period.

In the association's earlier Q2 quarterly survey of suppliers - which assesses market conditions and future expectations - 35% of respondents expected market conditions to improve or remain steady in the next quarter. Over the next 12 months, an identical percentage expected conditions to be 'steady-to-better' - five percentage points lower than for the previous quarter.

"Historically, there is a bump up in shipments in the fourth quarter," said Pineda. "It would not be surprising to see that shipments in the fourth quarter are above the third quarter."

> [www.plasticsindustry.org](http://www.plasticsindustry.org)

## Greenpeace recycling report is slammed

The Plastics Industry Association has responded strongly to a new Greenpeace report which condemns recycling as a "dead-end street" and concludes that "most plastic simply cannot be recycled".

The report also claimed that while US households generated an estimated 46 million tonnes of plastic waste in

2021, only 2.2m tonnes was recycled and no type of packaging in the US can be considered recyclable.

Matt Seaholm, president and CEO of the organisation, said: "The activists at Greenpeace cannot call themselves environmentalists while simultaneously discouraging recycling as part of the solution to our world's waste problems."

He said: "Recycling is real, and the claims that it can't ever work, made in this document, will likely result in unnecessary waste and public reaction that could actually cause greater environmental harm."

The report is available [here](https://www.greenpeace.org).

> [www.greenpeace.org](https://www.greenpeace.org)

> [www.plasticsindustry.org](http://www.plasticsindustry.org)



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# Plastics output in Europe grew in 2021

Plastics production in Europe grew by 6% in 2021 to reach 57 million tonnes.

According to trade association Plastics Europe, the rise outstripped that of global plastics production - which rose by 4% to 391m tonnes. However, the organisation expects plastics production in the EU to decrease by 4% in 2022 - due to the war in Ukraine.

The figures were revealed in 'Plastics - the Facts 2022', an analysis of the latest data related to plastics production, demand, conversion, and end-of-life management in Europe.

The report reveals that, in 2021, more than 1.5m people in Europe were directly employed in the plastics industry - a slight increase from 2020. There were over 52,000 companies -

most of them SMEs - distributed across the EU with a combined total turnover of approximately €405 billion (US\$424bn).

Post-consumer recycled materials accounted for 10% of the total plastics production figure. There was also a 20% increase in recycled content in new plastics products in the EU27+3 compared to 2020 - reaching 5.5m tonnes.

The data also shows that China's share of global plastics production continues to grow and reached 32% in 2021, as Europe's share continued to decline to 15%.

Plastics Europe said this loss of competitiveness could be exacerbated further by energy and other crises.

> [www.plasticseurope.org](http://www.plasticseurope.org)



## PVC blister pack winner

Perlen Packaging of Germany is one of the main winners at the latest Inovyn awards for its Peralux PVC mono-material blister.

The packaging has a push-through, transparent lid film - allowing the company to make a recyclable blister made completely from PVC. It was named the gold winner in the circularity category.

The Inovyn awards take place every three years - and the 2022 ceremony

took place at K2022 recently. It attracted more than 130 entries, according to the organiser.

Other winners with a film and sheet focus included: Comfort Banho, for its PVC inflatable bathtub for caregivers; and Renolit, for a film that protects wind turbines from corrosion.

■ Our review of K2022 begins on [page 31](#).

> [www.perlenpackaging.com](http://www.perlenpackaging.com)

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# Clean breakthroughs: latest in melt filtration

*Many exhibitors at K2022 were showing advances in melt filtration - which can improve the processing of recyclate - with features including back-flushing and improved performance*

The increasing use of recyclate in products such as packaging is typically driven by legislation. It has meant that producers must be confident of maintaining product quality - and one way of doing this is with more effective filtration of the polymer melt. This is something that many suppliers have been working on.

**Nordson**, for instance has developed a new melt filter that can help blown film producers use higher amounts of recycled materials.

A film bubble can be highly sensitive to changing process conditions such as temperature, viscosity, and pressure. Filters typically provide process stability and deliver clean, homogenous melt for blown film - when virgin material is used. However, processing more recyclate can cause process disruption.

The new melt filter - the BKG HiCon K-SWE-HD/RS - is based on Nordson's backflush technology and enables the use of recycled material while keeping the process stable and end-product quality at a high level, it says. It was introduced at K2022.

"Melt filters without a backflushing function have limits when processing recycled material: contamination levels are high and the screens clog fast," said Stefan Woestmann, process specialist at Nordson.

Screens are expensive and the changing procedure can be time-consuming. With backflushing, screens are cleaned of contamination and debris many times, so producers need fewer filter elements and operators need to perform fewer

screen changes.

To cope with the high process pressures in blown film applications, Nordson made patent-pending changes to its backflush technology. It was important to remain pressure-constant - even under difficult conditions - to ensure high film quality, said Woestmann.

Pressure consistency is essential for the successful operation of a blown film line - and this can be done through intelligent solutions.

"The new melt filter has a patented melt-pressure-controlled venting start that fully automates the filling of the screen cavity after a screen change for maximum pressure consistency," said Woestmann.

In addition, the filling is done so carefully that no air entrapments endanger the process or end product, he said.

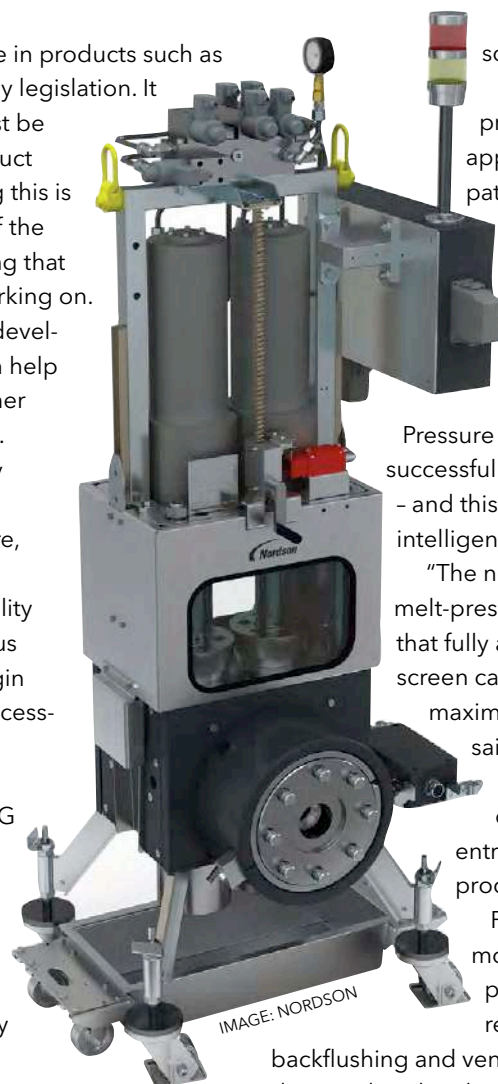
Processing recyclate generates more waste than that of virgin polymers because melt is removed from the filter during

backflushing and venting. The new melt filter is designed so that this happens in a clean, maintenance-friendly way. The safety cover can be opened vertically, allowing the operator to reach the filter piston from all sides, which helps with cleaning.

## PET melt filtration

Melt filtration specialist **Britas** highlighted its new ABMF-PET-C unit on its stand at K2022. The system, which has been designed for use with PET and other low-viscosity materials, was a winner at the Plastics Recycling Europe Awards. ➤

**Main image:**  
**Nordson's new melt filter can help blown film producers use higher amounts of recyclate**



The ABMF-PET-C was developed by Britas in co-operation with a PET recycling customer, according to Thomas Lehner, CSO and MD at Britas. The customer, which recycles PET bottles, has already bought a second system.

“PET is a material that challenges you,” said Lehner.

The ABMF- PET-C was developed to deal with filtration challenges and achieve high quality pelletised granules, while enabling customers to run their lines efficiently due to its automatic operation with a continuous melt process.

The fineness level of the system is as small as 20 microns, he said.

### Recycling systems

**Maag** says that its recycling systems make it a strong partner for the circular economy in the plastics recycling industry.

Its downstream equipment recycling systems help users to remove heavy contaminants such as paper, aluminium and wood to produce reusable pellets. The systems are co-ordinated to each other and can be operated via the company’s proprietary control system.

Modern recycling systems must be able to handle feedstock of varying quality grades. With this in mind, the EX125-6 recycling pump provides precise, uniform pressure for downstream filtration over a wide range of feedstock inputs.

At the heart of Maag recycling systems is the Ettlinger recycling melt filter, which runs continuously at high performance, says the company. Melt with contamination content of 16% and particle sizes up to 4mm can be pumped into the filter for removal and discharge. The Eco 1000 achieves throughputs up to 10,000 kg/h depending on filter fineness ranging from 60 m to 1800 microns. Both the ERF and Eco series are capable of filtering almost any polymer used in recycling operations, in the production of products such as recycled

**Right: Britas showed its new ABMF-PET-C unit on its stand at K2022**



IMAGE: D. ELDRIDGE

### Real time oil quality sensor and data collection and monitor from US company Early Warning Technologies



## Oil monitoring unit to protect gearboxes

Process + Filtration Products in the USA provides technologies for filtration of polymers, water and oil. It sells Rajhans Plastics Machinery RJC and RJSC dual-channel screen changers, made in India. The company, headed by Bob Vogel, also has a business called Early Warning Technologies (EWT), which offers sensor-based technologies and a dedicated alarm and monitoring system to provide alerts of potential failure of engines and equipment using lubricating or hydraulic oils.

He says one of the key factors in proper performance of gearboxes is maintaining the protective qualities of the lubricating oil. Oil will, over time, lose its lubricating protective qualities. This will be as a result of being subjected to excessive heat, the effects of shear, contamination by dirt and water or particulates. The deterioration of the oil will eventually cause gear components, seals and other parts of the gear box to wear requiring maintenance or replacement.

EWT’s oil monitoring program incorporates an oil quality sensor and Express Monitor technology developed by Tan Delta Systems to provide continuous monitoring of the oil by sampling it every 60 milliseconds with a sensitivity of 15 ppm.

The real time data collection and analysis will indicate trends and sources of accelerated oil degeneration, pinpointing the exact time and its nature. Sensor data is captured and displayed in a traffic light format for an immediate visualisation of the oil condition. The monitor also shows the TD Number index, representing oil quality values from new to end-of-life, rate of change and temperature. EWT’s technology group provides support in data interpretation and identifying potential sources of oil degeneration.

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# PET flake from bottle waste

German company **BB Engineering** has delivered a melt filter to polyester manufacturer Indorama Polyester Industries (Thailand). It says Indorama will use the type NSF38 filter in its recycling system for producing rPET granulate from flake PET bottle waste.

The NSF38 filter enables continual filtering. The system switches from one filter to the other during the process without the need for conversion shutdowns. It has a filter surface area of approximately 16 sq m on each side, with throughputs of 1,000-1,900 kg/h.

The filter inserts each contain 19 pleated filter candles. The filter medium comprises a sintered metal fibre nonwoven with a filtration fineness of 25 microns, which is sufficient to ensure that the melt remains free of contaminants and gels.

BB Engineering is a joint venture between Oerlikon Barmag and Brückner Group, focusing on the development, engineering, design and manufacturing of extrusion and filtration technologies.



IMAGE: BB ENGINEERING

pellets, sheets and film, says Maag.

All Ettliger recycling melt filters operate continuously, keeping the volume and pressure of the melt stream constant. This avoids increasing extruder speed, and as a result, cuts energy consumption by as much as 30%.

## Models on display

**Gneuss** exhibited several different models of its patented rotary filtration systems at K2022. These are characterized by a filter disk on which the screen cavities are located in a ring pattern. Screens can be changed on the part of the filter disk that is not active in the melt channel, while production continues without interruption or disturbance.

Its main model, the RSFgenius, has an integrated back-flushing system offering self-cleaning for demanding applications. Screens can be automatically re-used up to 400 times and filtration fineness below 10 microns/1200 mesh is available. An RSFgenius 250 was on display at K2022. It has an active screen area of 1350 sq cm and throughputs

of several thousand kilos per hour, depending on the type of polymer and the filtration fineness.

Retrofitting an RSFgenius to an existing extrusion line, such as for sheet production, allows the use of more contaminated - and often cheaper - material.

There was also an SFneos 150 and SFXmagnus 90 on display. These are also continuous, pressure and process constant, but not backflushing - so the systems are for applications that do not require self-cleaning. The SFneos 150 offers an active filtration area of 450 sq cm for applications such as foamed sheet or battery separator film. The SFXmagnus 90, with its encapsulated design, offers an active filtration area of 350 sq cm for applications such as PET or BOPP sheet.

In addition, it teamed up with **Colines** to offer manufacturers of stretch film the possibility of using recycled polymer.

Colines offers a special cast and blown film extrusion process for handling recycled material, with help from the RSFgenius. It has already proven the process with up to 40% recycled content in the manufacture of 10 micron stretch film.

The constant melt pressure offered by the RSFgenius is a major benefit when processing recycled material and its efficient self-cleaning function removes production disturbances. In addition, it operates fully automatically and rarely needs any attention - another advantage of the Colines extrusion process.

## Laser precision

**Erema** presented several new recycling systems and components at K2022 - including a new laser filter. The 50% increase in the screen area of the Erema 406 laser filter helps to ensure lower pressure and temperature at the same throughput

**Below: The Ettliger recycling melt filter sits at the heart of Maag recycling systems**



IMAGE: MAAG



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rate, says the company.

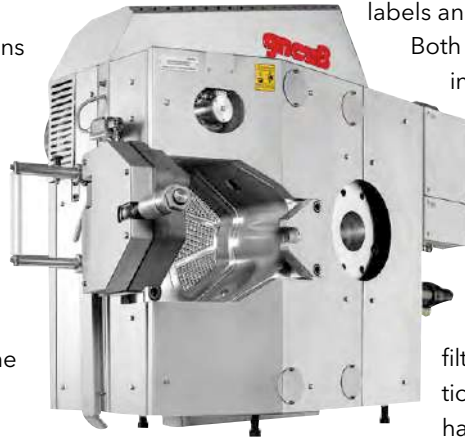
"This allows even finer screens to be used - for even better results - in quality-intensive plastics applications," said Robert Obermayr, head of Erema's Powerfil subsidiary.

The Quattro version of the LF 406 laser filter can filter up to 9,000 kg/hr of melt.

"Plastic recycling has become a must-have, even for input streams with higher levels of contamination," said Obermayr. "Efficient filtration systems are indispensable for achieving the specified melt quality using existing extrusion systems."

For this reason, the company offers the melt filters as individual components for existing Erema machines and third-party extrusion systems. The product range includes the SW RTF partial area backflush system and the laser filter. The range is aimed at both manufacturers and recyclers - because they can be used to process post-consumer plastics as well as post-industrial films with paper

IMAGE: GNEUSS



labels and clean PET material.

Both types of filter are easy to integrate into an existing recycling plant and available in many sizes and variations. Whether the customer uses the backflush filter or the continuous laser filter depends on the throughput and level of contamination of the material. The laser filter is ideal for heavy contamination, says the company - and can handle impurity levels up to 5%

and filtration as fine as 70 microns while continuously cleaning the screen with a scraper.

**Right: The RSFgenius, from Gneuss, has integrated back-flushing that offers effective self-cleaning**

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**4,600+**  
attendees



**300+**  
exhibitors



**100+**  
speakers



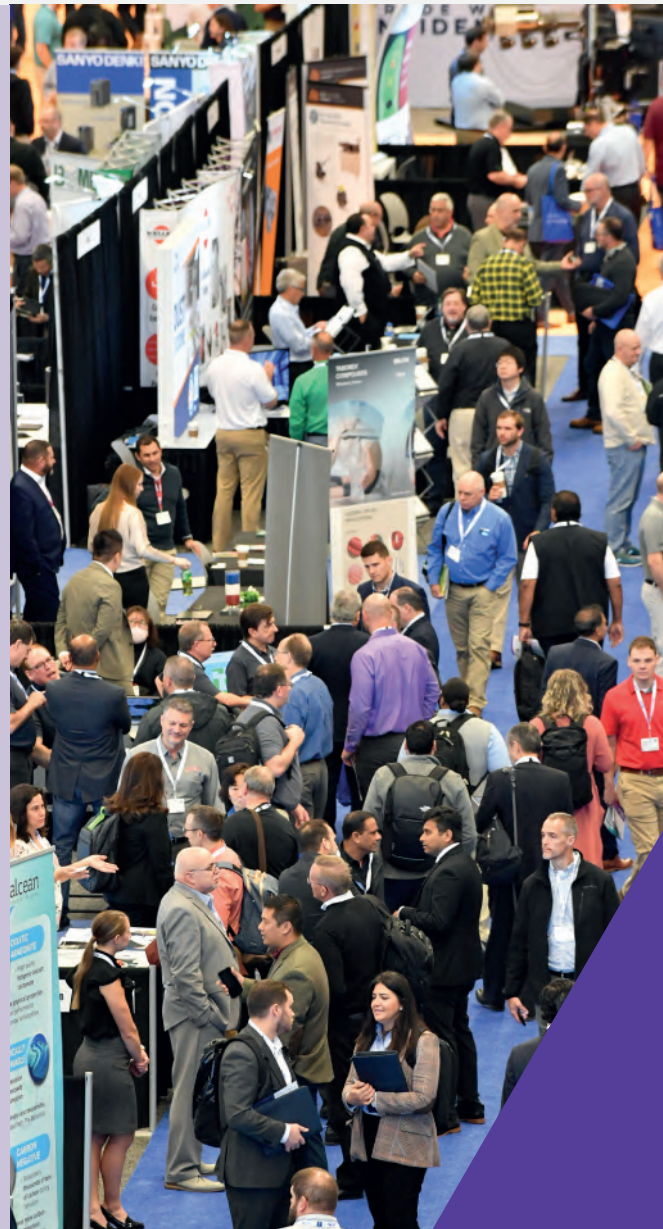
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The chemical recycling industry is at a pivotal point in a volatile market environment



'All that is gold does not glitter' - chemical recyclers' quest for feedstock emphasises the necessary shift from "waste" to "resource"

# Charge sheet: advances in static control

*Static control solutions can improve product quality - and safety - in a multitude of plastic extrusion processes, from printing to film production*



Static electricity can cause a variety of problems in the production of plastics extrusion - ranging from poor product quality to potential danger of electric shock to employees. For these and other reasons, controlling static is critical to production.

**LMI Packaging**, a US-based manufacturer of pressure sensitive labels, is using corona treatment equipment from **Vetaphone** in order to maintain product quality.

The company currently has a bank of flexo presses, which print in up to 11 colours that are highly specified.

"Our previous presses were fitted with a brand of treater that was not 100% reliable - especially in the humid conditions we experience in summer," said AJ Chivell, director of engineering at LMI. "They were also difficult for the operator to access for cleaning, maintenance, and adjustment."

This led to the company specifying Vetaphone corona treaters for its new presses. Vetaphone says that its models commonly cope with humidity. They are designed so that the power unit is separated from the treater station. This, combined with the slow start-up mechanism on the iCorona generator, removes the danger of any condensation causing cut-out or corrosion issues.

Vetaphone VE2A treaters are fitted to the company's flexo presses which stops production stoppages from condensation causing a power outage on the corona unit.

"Not only are they reliable and consistent in power delivery, but the location and size of the units makes them easy for the operator to carry out all the necessary jobs to maintain performance," said Chivell.

With a wide variety of substrates - including PET

and BOPP - being processed at high speed, the company says it needs equipment it can rely on.

"Vetaphone corona treatment technology will be fitted to our new flexo press - which is due to be installed soon," he added.

## Static measurement

**Exair** says that its 7905 digital static meter is an easy-to-use, handheld tool for measuring and identifying sources of static in the production process.

Static electricity can cause problems in manufacturing - affecting product quality - by causing jamming or tearing and hazardous shocks to employees. The digital static meter can pinpoint high-voltage problem areas in a facility at the touch of a button.

Static is typically created by two non-conductive surfaces rubbing together - or quickly pulling apart - creating an imbalance of ions. The meter is a sensitive and responsive product that indicates surface voltage and polarity on objects up to  $\pm 20$  kV from one inch (25mm) away. After zeroing the meter, it is moved to within one inch of a problem surface. It gives an LED-illuminated reading of the static voltage. It includes a National Institute of Standards and Technology certification for accuracy - and is CE compliant.

## Static generation

UK-based **Fraser Anti-Static Techniques** showed several products at K2022 - including its Ionfix range of static generators.

The range has been designed for creating temporary adhesion in applications such as IML, pinning and bagmaking.

**Main image:**  
**Simco showed a number of its air knife products at K2022**

IMAGE: VETAPHONE



**Above: LMI Packaging uses Vetaphone corona treatment equipment on several of its flexo presses**

The use of Static Generation for temporary adhesion is increasingly popular because it is fast, clean, controllable and economic, says the company.

Fraser generators and electrodes provide the user with a complete temporary adhesion system that is easy to use, reliable and safe. Flexible interface design facilitates full integration with modern machinery and control systems.

The Ionfix Compact is a 30 kV, 20W generator. It delivers a full 20W of power from 20 kV up to 30 kV. There are two models: 24V DC 90; and 250V 50/60Hz AC. It is available in positive and negative polarities and has four HV output connections.

**Air knives out**

**Simco** of the Netherlands showed a number of its air knife products - in conjunction with anti-static bars - at K2022.

Its air knife with Performax IQ Easy is for situations where the ionisation or cleaning needs to be mobile - such as cleaning parts with a robot. With a 24V connection, it is easy to install in these applications. The model is standard and available in four lengths - 150, 310, 460 and 610mm - though longer combinations are available on request.

The working distance is 3000 mm maximum. It removes dust and other contamination and neutralises the static charge and prevents retraction contaminants. Installation is possible on moving machine parts such as a robot arm.

The company also showed its Typhoon air knife in combination with either its EP-Sh-N or P-Sh-N-Ex anti-static bars. In each case, the air knife is con-

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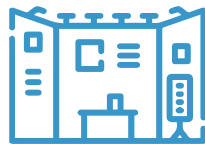
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**Right: Baldwin showcased its Film Cylinder Cleaner at K2022**

structured of extruded aluminium with incorporated mounting grooves. This provides a precise air volume over the entire width of the air knife.

Typhoon systems with EP-Sh-N anti-static bars incorporate a power unit type A2A7M. This contains an additional 12V power source for connection of the air pressure sensor. For use in hazardous zones, the Typhoon with the P-Sh-N-Ex anti-static bar is approved.

**Corona treatment**

**Baldwin** showcased a selection of its corona treatment and surface-cleaning technologies at K2022 - including its Film Cylinder Cleaner and Corona Slim/Extrude.

“The market remains strong despite global uncertainty, which means our customers have a lot on their minds - be it supply chain uncertainty, constraints or inflation,” said Oliver Jentschke, vice president of sales for Europe at Baldwin.

The Film Cylinder Cleaner is an automated system that cleans the cylinders used in film extrusion, using a cloth-roll-based cleaning apparatus that spans the width of the extrusion web. This is paired with a rotor spray system that precisely applies cleaning detergent to the cloth.

Available in 3,000 and 6,000mm widths, the Film Cylinder Cleaner features a touchscreen panel, which enables easy operation of the various cleaning modes. Automating the cylinder-cleaning process eliminates risk of damage to the cylinder, improves worker health and safety, and increases uptime.

Baldwin also showcased the Ahlbrandt Corona Slim/Extrude. The energy-efficient corona system increases the surface energy of materials such as plastic films. Ahlbrandt systems are also used in converting, narrow-web flexography, parts manufacturing and many other applications. They are commonly used for the surface-wide handling of plastic films and metallised films.

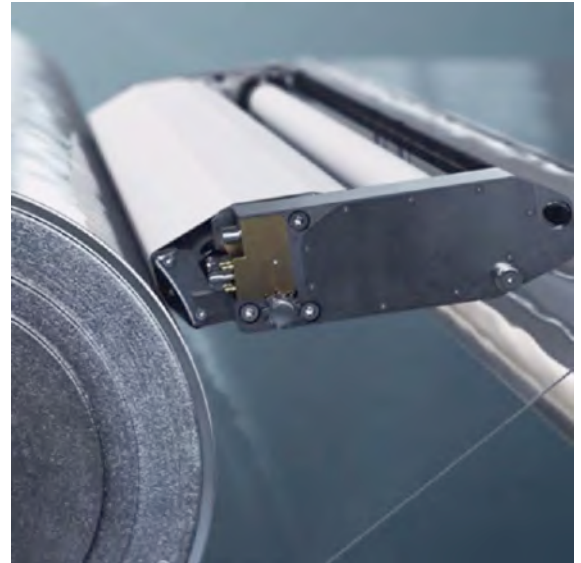


IMAGE: BALDWIN

“The biggest differentiator of the Ahlbrandt corona treatment systems is how we use four electrodes instead of the common ‘two-up’ design,” said Alexander Rau, Ahlbrandt product manager at Baldwin. “Since it requires only one housing, the electrodes can be changed in just a few seconds - maximising production uptime while improving treatment results.”

In addition, the rotor spray application system is an effective way to apply liquids uniformly to films and other substrates on web lines. Using rotary disks to achieve this uniformity, coatings and chemicals such as anti-fog or anti-static solutions can be applied to one or both sides of a film. Different liquids can be used on each side of the web.

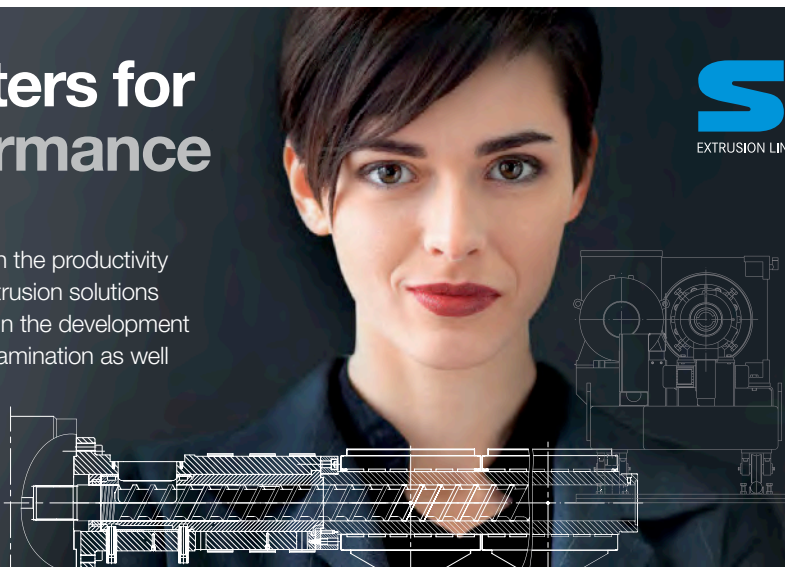
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*Recent developments in foamed sheet include a process to cut product weight by 20%, a new range of integral skin PVC foam sheets and cross-linked foams that use post-industrial waste*



IMAGE: ZOTEFOMAS

# Light work: advances in foamed sheet technology

Foaming technology has gained popularity recently because it can help to reduce material use in products such as sheet. As long as this can be done with no loss of mechanical properties, it means that a product can be made with less material - which has both cost and sustainability advantages.

**Promix Solutions** says that its Microcell Technology can help to reduce raw material consumption in extrusion processes by up to 20% without losing mechanical properties.

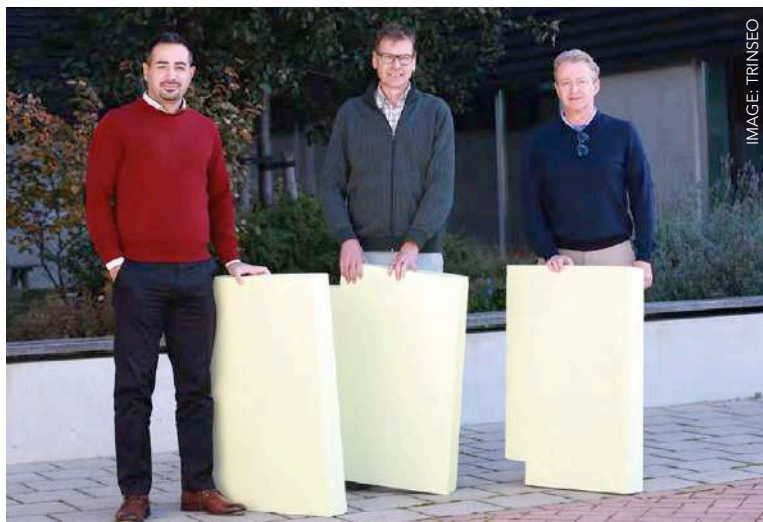
It uses blowing agents such as carbon dioxide and nitrogen to perform physical foam extrusion on products such as sheet and film.

Until now, density reduction in physical foaming caused some loss in mechanical properties. Promix says that its technology overcomes this - making the technique more attractive to end users.

The secret of high-quality physical foaming lies in the cell structure. Tests have shown that very small, evenly distributed cells significantly improve mechanical strength. A foam with 50-micron cells has 27 times more cells than a foam with 150-micron cells - at the same density. This explains why the mechanical behaviour of microcell foams is different. There are several factors behind achieving small cells, including: dispensing the blowing fluids with very high precision - and in a supercritical stage; unique cooling and mixing equipment; special nucleation technology; and improved process know-how.

In one example, a thermoformed PET tray foamed with Promix Microcell Technology showed the same mechanical top load properties as a solid tray but was 18% lighter. A non-foamed benchmark tray - which is also 18% lighter - shows

**Main image:**  
**Zotefoams'**  
**Ecozote**  
**closed-cell**  
**crosslinked**  
**foams incorporate**  
**30%**  
**post-industrial**  
**waste**



**Above: Abidin Balan, Gilbert Bouquet and Luc Bosiers, of Trinseo's polystyrene R&D team, developed Styron X-Tech 4660**

significantly reduced top load properties. This proves that the new process is an effective way to save up to 20% raw materials without affecting mechanical properties.

In addition, it reduces energy consumption. The internal and external recyclability remains intact and is equivalent to the non-foamed products.

The technology works for all types of extrusion processes including packaging films, sheets and boards and blown film. It can be retrofitted to existing extrusion lines and installed on new lines. Promix is working with a number of machine builders to do this.

### Integral skin

**Simona** of Germany has developed its Celplast range of integral skin foam sheets, which are made at its centre for PVC foam products in Turkey.

The range is likely to be added to Simona's PVC product portfolio in early 2023. Celplast is made using a semi-Celuka process - which prevents cell formation on the surface of the molten material through an immediate reduction in temperature. It produces a compact, smooth and even surface. The result is a foamed PVC sheet that is lightweight and strong - offering good surface quality and low thickness tolerance across the entire width. This makes it suitable for design and construction applications.

### Closed-cell

**Zotefoams** launched Ecozote - a range of closed-cell crosslinked foams - at K2022.

Ecozote LDR18 and LDR27 are crosslinked LDPE grades incorporating 30% post-industrial waste that comply with emerging requirements for recycled content in product protection applications. After several months of trials, the grades are available as alternatives to their Plastazote PE foam

counterparts - which are made from virgin material.

"LDR18 and LDR27 with 30% recycled content are part of the first Ecozote product line driving plastics circularity, with more to follow," said Karl Hewson, director of technology and development at Zotefoams. "With Ecozote, we are building on the underlying sustainability credentials of all our block foams: lightweight, durable and foamed using nitrogen as a blowing agent."

In addition, the company presented a range of technical block foams, spanning its Azote polyolefin foams range - including Plastazote - and Zotek high-performance foams, which are made from engineering polymers and designed for demanding applications.

Zotefoams makes its T-Fit modular foam insulation from Zotek. T-Fit is used in applications in the pharmaceutical, semiconductor and food and beverage industries.

"Sustainability is a complex topic. Often, only a detailed life cycle assessment will identify what is truly the most sustainable solution," he added. "With Ecozote, we are building on the sustainability credentials of all our block foams."

### Insulation board

**Trinseo** has commercialised its Styron X-Tech 4660 polystyrene resins for extruded polystyrene (XPS).

The material - based on patented cross-linked polystyrene technology - allows customers in the building and construction industry to reduce material consumption in foam insulation boards.

"Customers can lower foam insulation board density without compromising compression strength," said Alain Minelli, business manager of copolymers and polystyrene.

With XPS insulation board, the closed cell foam structure is responsible for providing long-term durability and rigidity.

"The new material impacts this structure by introducing increased melt strength to enhance performance and allow for raw material and cost savings," he added.

The material offers the same performance as previous formulations, with improved sustainability. It has been validated by several Trinseo partners - who have reduced the weight of insulation board by around 5%, and carbon emissions by "a corresponding amount".

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*In the face on ongoing travel restrictions - which prevented visitors from Asia in particular from attending - K2022 seemed as busy as ever, and packed with the latest technologies*



# Visitor numbers hold up despite travel restrictions

Despite the lingering effect of Covid 19, the organiser of this year's K show - which ran for eight days in late October - was satisfied with visitor numbers. As with K2019, sustainability was one of the major topics and themes of the exhibition.

The show - in its 70th anniversary year - drew in around 224,000 visitors. That was 22% less than the last edition in 2019 - though comes at a time when many restrictions continue to affect international travel.

"After hardly any trade fairs could take place worldwide over the past three years, K2022 was all the more eagerly anticipated," said Ulrich Reifenhäuser, chairman of the exhibitor advisory board at K2022.

The final attendance is thought to be at the high end of organiser Messe Dusseldorf's private expectations.

More than 70% of visitors came from outside of Germany - with the Netherlands, Italy, Turkey,

France, Belgium, Poland and Spain the most represented European visitor nations. According to Messe Dusseldorf, 42% of visitors came from beyond Europe. It said that Covid quarantine regulations had reduced attendance from south-east Asia - but that the US, Brazil and India were well represented.

Messe Dusseldorf ran three 'hot topics' at the show: circular economy; digitalisation; and climate protection. In addition, the 'Plastics shape the future' programme included presentations on topic as diverse as: moving to climate neutrality; strengthening digital tools to accelerate a circular economy; and how plastics can help towards climate protection.

The following pages include launches from this year's event. Many other technologies were seen at the show and may be featured in future editions in their relevant subject areas.

The next K show is held on 8-15 October 2025.

**Main image: A wide variety of technologies were on show across K2022**



IMAGE: BAERLOCHER



**Above: Baerlocher has helped several customers to use more PCR in film formulations**

**Baerlocher** has applied its Baeropol T-Blends technology to a number of plastics recycling projects.

The technology uses a family of customisable additive blends that can replace traditional antioxidants to stabilise polyolefin resins more effectively than standard binary antioxidant blends, says the company.

“Collaboration is fundamental in achieving our industry recycling objectives,” said Ed Hall, CEO of Baerlocher USA. “Our industry-leading solutions facilitate the increased use of recycled content without sacrificing quality and performance.”

In one example, it has worked with Revolution, a recycler based in Little Rock, Arkansas. Here, Baerlocher’s expertise in stabilising PCR content and the use of its Baeropol T-Blends were used during the development phase of new higher-performing PCR resins for film applications.

In another project, with Cascades Flexible Packaging, the technology helps the company to achieve higher-quality recycled content and increase its use in film applications.

“We are committed to developing films with a high percentage of recycled content, to improve our carbon footprint and provide higher quality to our customers,” said Fabricio Smillo, technical manager of Cascade Flexible Packaging. “We are collaborating closely with Baerlocher team and using T-Blends to increase the oxidative induction time (OIT), melt stability and physical characteristics of various PCR/PIR resin sources.”

> [www.baerlocher.com](http://www.baerlocher.com)

**BASF** announced availability of Product Carbon Footprint (PCF) data for a number of new products at K2022.

Produced using its own digital PCF application,

the cradle-to-gate calculations are based on GHG emissions from its own plants – combined with either average data for purchased raw materials and purchased energy, or supplier-specific data as it becomes available.

The first PCF data has been made available for several antioxidants and light stabilisers in its Irganox, Tinuvin and Chimassorb additive ranges.

During the show Marina Leed, plastic additives sustainability specialist at BASF, highlighted the company’s Valeras platform – which brings together additives and services that have sustainability benefits and its new IrgaCycle range of additives to improve the properties of mechanically recycled plastics.

The company also launched Ultraform lowPCF, a new addition to its POM range that offers a PCF at least 30% lower than one of its conventional Ultraform grades by using green electricity and energy-efficient production technology.

> [www.basf.com](http://www.basf.com)

**Borouge** has developed a method to incorporate post-consumer recycled (PCR) content into PE-based heavy duty shipping sacks.

New sacks are made from 30% PCR content – originally used in the same type of product – together with Borouge’s Borstar and Anteo PE grades.

Borouge worked with partners, Han King Plastic Machinery, Kunshan Golden Alliance, Shanghai Longstone and Shanghai Tianqiang to develop the closed-loop PE for heavy-duty sacks, with the aim of developing a sustainable solution with a lower carbon footprint.

**Right: Borouge and partners have developed a heavy-duty shipping sack with 30% PCR content**

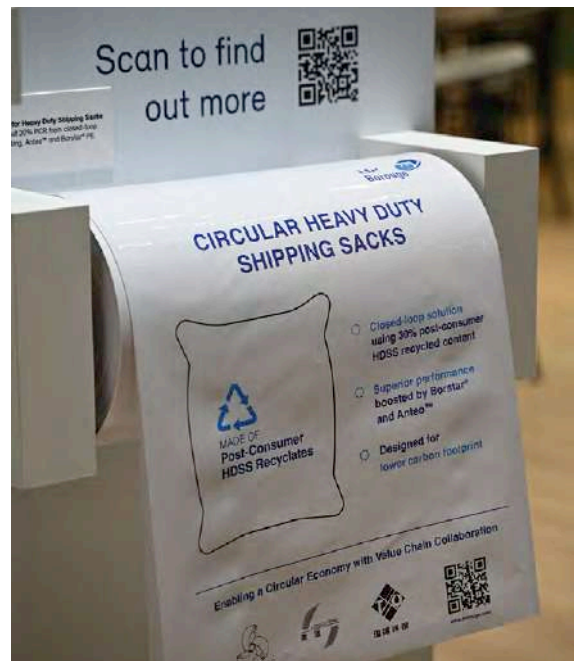


IMAGE: BOROUGE





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**Right: AJ Plast of Thailand has invested in a high-speed BOPP line from Bruckner**

Material from used sacks is recovered through waste collection streams, then mechanically recycled. The recycled resins are then incorporated – with virgin PE – to the end application.

“This circular solution enables multiple recycling cycles within the same application, which takes us a step closer towards a circular economy,” said Eddie Wang, senior vice president for Asia North at Borouge.

> [www.borouge.com](http://www.borouge.com)

AJ Plast, a film manufacturer based in Thailand, announced at K2022 that it has invested in a new high-speed BOPP line from **Bruckner Maschinenbau**.

The five-layer, 10.4 metre wide line has a line speed of 600 metres per minute and an output of 7.5 tonnes per hour. It is the company’s 15<sup>th</sup> line supplied by Bruckner.

“With this new line we increase productivity and reduce energy consumption at the same time,” said Kittiphath Suthisamphat, owner of AJ Plast. “That’s two of our major goals for our future film production focusing on environmental sustainability.”

The new machine is also expected to reduce



IMAGE: BRUCKNER

water consumption. A newly designed double air heat exchanger in the kiln process preheats fresh air and takes energy recycling to a new level, says Bruckner.

Xaver Sedlmeier, sales director at Brueckner Group Asia-Pacific, added: “We have designed a film stretching line that is completely tailored to the needs of AJ Plast – and the needs of the market.”

> [www.brueckner.com](http://www.brueckner.com)

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**Bunting** displayed several metal separation technologies at K2022 – including magnetic separators, metal detectors and an eddy current separator.

The range of magnetic separators on show included FF Drawer Filter Magnets, which are widely used in plastic manufacturing plants. They use rare earth magnets to hold and remove small ferrous metal contamination.

The five metal detectors displayed are designed for installation at different stages within the manufacturing process and to handle specific materials. For example, the QuickTron 05 and 03R models detect and separate metal contamination in free-fall applications.

For removing small non-ferrous metal found when recycling polypropylene, PET or film, Bunting has developed the High-Intensity Eccentric (HIE) eddy current separator. This uses magnetic forces to physically repel non-ferrous metals and enables separation from non-conductive materials. At the show, visitors saw a production-size eddy current separator and drum magnet separating small ferrous and non-ferrous metals from shredded PET.

➤ [www.buntingmagnetics.com](http://www.buntingmagnetics.com)



IMAGE: BUNTING

**Clariant** has launched a portfolio of new products to improve the quality of products that are derived from pyrolysis oil from chemical recycling.

Projects for chemical recycling of plastics waste are increasing, with a large proportion based on pyrolysis technology. However, pyrolysis oil produced in these facilities is likely to require further processing to remove contaminants before it can be used as a feedstock for new polymer production, says Clariant.

**Above: Small aluminium can be removed from PET using Bunting's eddy current separator**



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Top: Partly coated with anti-fog



Bottom: Stacked packaging, coated with anti-block

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**Right: Comexi's F2 Origin flexographic printer improves efficiency, ergonomics and print quality**

Contaminants can include by-products of nitrogen, oxygen and sulphur in differing amounts. Clariant's new HDMax catalysts and Clarit adsorbents are tailored to remove a wide range of contaminants that are - which it says enables the flexibility that pyrolysis oil producers require.

Séval Schictel, global business development manager at Clariant, said during K2022 that - in small volume pilot plants - contaminants are diluted to low levels - but the need for pyrolysis oil purification is becoming important as chemical recyclers aim to start up production scale facilities from 2025.

Schictel said its Clarit adsorbents are designed for use in the first step, where they target a range of different contaminants to adjust for variability of input materials.

The second step involves catalytic hydrogenation using the HDMax catalysts.

In addition, the company also launched a new product carbon footprint (PCF) tool. It says the CliMate automated carbon footprint calculator allows it to offer consistent cradle-to-gate greenhouse gas (GHG) emission data for all of its products.

> [www.clariant.com](http://www.clariant.com)

At K2022, **Comexi** presented its new F2 Origin flexographic printing press.

The model, part of the Comexi F2 flexo machinery line, incorporates GeniusTech developments that improve efficiency, ergonomics and printing quality while decreasing operator dependency. This new machine, available from next year, has a refurbished design.

It includes new intercolour and tunnel nozzles to optimise the efficiency and performance of GeniusDry - the new optimised GeniusFlow inking system - as well as allowing full integration of GeniusPrint. The machine is designed to be productive not only for short, medium and long runs.

GeniusDry offers advantages including high-performance intercolour and tunnel nozzles that allow for superior drying capacity with less total air in circulation. As a result, GeniusDry has higher efficiency, less sound emission, and an upper platform with access to tunnel and drying circuits for uncomplicated maintenance.

GeniusFlow offers an optimised circuit that reduces the use of ink and solvent, one pump system to reduce

maintenance, as well as air consumption, pipeless doctor blades for easy change and GeniusDoctoring for minimal dot gain.

GeniusPrint offers minimum waste and high precision at the push of a button, less dependency on operator skills and rapid job changeover resulting from minimum waste and time.

The F2 Origin has a variety of configurations, from single unwinder and rewinder for the shortest runs, to a turret unwinder and rewinder for long-run maximum performance.

> [www.comexi.com](http://www.comexi.com)

At K2022, **Davis-Standard** announced the systems integration of its EDI Prodigy die system - a more responsive automatic profile control (APC) die for cast film, sheet and extrusion coating.

The die, tested at Davis-Standard's lab in Fulton, is three to five times faster than previous heated die bolt type systems. The new APC uses a direct motorised bolt adjustment for instant modification versus slower responding heaters used in current thermal bolt models.

"The Prodigy die, when integrated with our control system, can achieve APC control specification in a few minutes - compared to more than 10 minutes when using a heated die bolt," said Rick Keller, vice president of market development for converting systems at Davis-Standard.

"Being the process control system integrator of EDI/Nordson in this endeavour - as well as other vendors for major developments - enables us to deliver value-added technology to our customers."

The technology behind the die was presented during the show.

> [www.davis-standard.com](http://www.davis-standard.com)

**Dow**, in collaboration with machine manufacturers **W&H** and **B&B**, has developed a recyclable, wide-format MDO-PE bag - which uses only polyethylene (PE) and a minimal layer of EVOH.

The product is aimed at the pet food packaging market. The challenge for recyclable pet food packaging has been finding technologies that maintain the efficiency of the packaging's production and its final qualities - while relying



IMAGE: COMEXI

**Below: Davis-Standard says its Prodigy die is up to five times faster than heated die bolt type systems**



IMAGE: DAVIS-STANDARD

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**Right: Dow, W&H and B&B have developed a recyclable MDO-PE bag aimed at petfood packaging**

only a single material. "Packaging recyclability is a challenge that no one company can do alone," said Romain Cazenave, packaging EMEA marketing director at Dow Packaging & Specialty Plastics. "Dow's Elite, Innate and Affinity resins and sealants have helped realise the next generation of recyclable packaging."

The film was produced on a W&H Varex II machine with inline MDO. It has a final web width of 2 x 1260 mm and is optimized to reduce material wastage during production. It was then laminated at industrial scale before being made into bags on B&B's side-gusseted SFB bag machine. This produced 80 bags per minute, which is comparable to multi-material PET/PE structures.

- > [www.dow.com](http://www.dow.com)
- > [www.wh.group](http://www.wh.group)
- > [www.bub-group.com](http://www.bub-group.com)

At K 2022, 3S - part of **Erema** - presented innovations in wear measurement and screw production.

It demonstrated how a new type of cylinder enables ultrasonic wear measurements - and a new screw manufacturing technology leads to more efficient production. The company is a specialist in the manufacture of extruder screws for plastics and recycling, and each year processes between 1,500 and 2,000 screw and cylinder orders.

The company has developed a new type of cylinder that enables ultrasonic wear measurement of the extrusion screw and cylinder while the machine is running.

"This saves the customer from having to shut



IMAGE: DOW

down and restart the plant, remove and reinstall the parts, then clean and measure them - which would usually mean one to two days of machine downtime," said Alois Anreiter, managing director at 3S.

In another highlight, it showed a new screw manufacturing technology. In a special machine, profile grinding can be used to shape materials that would be too hard for conventional production methods. This allows the geometry and outer diameter of screws and other components to be ground in one pass, without re-clamping.

Further hardening treatment is no longer needed. When parts are removed from the machine, they are finished and through-hardened - with no final polishing required.

> [www.erema-group.com](http://www.erema-group.com)

At K2022, **ExxonMobil** demonstrated how its Exceed S performance polyethylene (PE) can be used in film design - through collaborations with several other exhibitors.

"Market interest in Exceed S PE has been phenomenal since it was introduced in April," said Tom Miller, marketing manager for the product at ExxonMobil.

Producers have already commercialised bag-in-box liquid packaging, full-PE laminated food packaging and heavy-duty sacks for polymer resins, he said - and 80 projects are undergoing commercial-scale trials.

Advantages of the material include its high stiffness and toughness - which help to simplify formulations, improve package durability and reduce film gauge.

The material was showcased on a number of partner stands at the show. Windmüller & Hölscher ran a five-layer, 40-micron collation shrink film containing 50% PCR. Exceed S 9243 and Enable 4002 were used to ensure that the film delivered acceptable holding force, stiffness, puncture and TD shrink.

In addition, Hosokawa Alpine featured Exceed S PE in high oxygen barrier concepts. These very high PE content (96-97%) MDO PE//PE laminates are alternatives to multi-material structures - which can be difficult to recycle. Exceed and Exact grades were used to deliver high stiffness and packaging integrity.

> [www.exxonmobil.com](http://www.exxonmobil.com)

**Below: Erema subsidiary 3S demonstrated its screw production technology at K2022**



IMAGE: EREMA

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IMAGE: KAMPF



**Above: Kampf presented both its Kampf and Atlas products - plus information on its digital services**

**Imerys** presented a number of innovations during K2022 - including news of a new talc facility in China and a new filler for breathable film.

The new €40 million ((US\$42m) talc processing unit in China is due to be commissioned in early 2023. The investment will help the company to meet customer needs in the region for high-performance sustainable solutions and enable customers

to benefit from better lead times and cost competitiveness.

In addition, FilmLink is an engineered, treated ground calcium carbonate (GCC) that has been specifically designed to promote breathability in polymer films used in hygiene products.

It also improves mechanical properties - enabling manufacturers to downgauge films while promoting faster throughput and reducing waste.

> [www.imerys.com](http://www.imerys.com)

**Kampf Schneid- und Wickeltechnik** presented a number of new strategies and products at K2022 under its Kampf and Atlas brands.

The two exhibits on its stand - the Kampf ConSlitter and the Atlas TitanSlitter - offer high productivity and flexibility, it said.

The ConSlitter comes with modern turret technology and automation to reduce downtime and increase production output. It is particularly suitable for processing smaller batch sizes. The Atlas TitanSlitter - also a turret slitter - has an even more compact design.

Atlas and Kampf have been working together since the end of 2020. A two-brand strategy opens

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**Right:**  
**Maguire's Ultra 2200 meets the high throughput needs of applications such as sheet extrusion**



IMAGE: MAGUIRE

up further market segments for both companies. The team also showed developments in primary slitting and winding. Atlas offers its ProSlitter BlackLine in a new design, with features that optimise the processing of BOPP, BOPE and other materials. The new PrimeSlitter BlackLine from Kampf can be used to process BOPET.

At the show, the companies also explained their range of digital service solutions - including their the@vanced integrative platform and the new customer portal my@advanced.

> [www.kampf.de](http://www.kampf.de)

**Maguire** introduced its new Ultra 2200 dryer at K2022.

The Ultra 2200 is designed to meet the higher throughput requirements of central drying and applications such as sheet extrusion and offers faster performance than conventional methods while using less energy, says Maguire.

While the principal phases of vacuum drying remain the same as those on existing Ultra models, the new machine uses a pair of identical multi-function chambers that alternate in sequence to provide uninterrupted flow of dry material. Each chamber can self-load, heat, vacuum, and dispense. This allows for a compact arrangement with a relatively low ceiling height requirement.

The new dryer incorporates load cell technology which allows operators to monitor and control each step of the drying process - for process optimisation throughout the drying cycle.

"Energy savings, faster drying times, less waste and quick material changes all contribute to the unrivalled value of Ultra dryers," said Frank Kavanagh, vice president of sales and marketing at Maguire.

> [www.maguire.com](http://www.maguire.com)

**Right:**  
**Reifenhäuser and Maku are to collaborate in automation systems for coextrusion adapters and slot dies**

**Reifenhäuser** has announced a strategic partnership with **Maku** - in automation systems for slot dies and coextrusion adapters.

The so-called PAM (precise, autonomous, mechatronic) system is available immediately - and exclusively - as an automation option for new Reifenhäuser dies and adapters, as well as for aftermarket dies from all manufacturers.

PAM enables producers in flat film and sheet production - and extrusion coating - to control the entire hot part (coextrusion adapter and die) via the line's control panel. This is much faster and more accurate than conventional control by hand or expansion bolt automation, says Reifenhäuser.

The main advantage lies in the use of motorised manual adjustment bolts in place of conventional thermal expansion bolts. The system was seen for the first time at K2022.

"With this automation option, we can now offer our customers a perfectly coordinated overall system," said Uwe Gaedike, managing director of Reifenhäuser Extrusion Systems. "With Maku, we will establish the technology in the market and continuously develop it further."

> [www.reifenhauer.com](http://www.reifenhauer.com)

At K2022, **SML** presented results of a joint R&D project - with Sukano and Kiefel Packaging - on a heat-resistant PET cup.

The cup combines transparency and recyclability and is suitable for thermoformed hot-filling or microwavable products. It offers an economic and easy-to-recycle alternative to PP and PS. Other advantages include short thermoforming cycle times and high stiffness.

"Because easy recyclability is becoming increasingly important, we opted for a transparent C-PET solution at an early stage," said Max-Phillip Lutz, product manager at SML.

Compared to coloured PET or PP and PS products, the recycling process of C-PET light is considerably easier, he said.

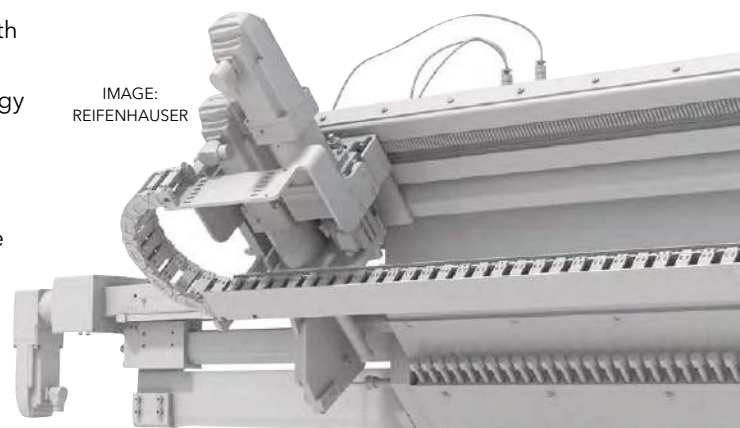


IMAGE: REIFENHAUSER

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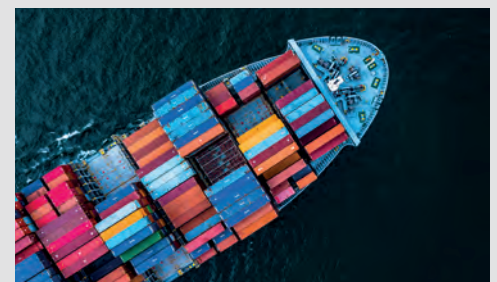
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**Starlinger Viscotec's ViscoZero makes food-grade recycled polyolefin and polystyrene resins quickly**



IMAGE: STARLINGER

The main technical challenges in the project were to find the optimum dosage for additives, to adjust the formulations and the process technology during film production, and to find the correct parameters for the thermoforming process.

- > [www.sml.at](http://www.sml.at)
- > [www.sukano.com](http://www.sukano.com)
- > [www.kiefel.com](http://www.kiefel.com)

At K2022, **Starlinger Viscotec** presented ViscoZero - a melt-phase decontamination reactor for making food-grade recycled polyolefin and polystyrene resins, and food grade and IV-increased recycled polyester. It is available as a turn-key solution or as upgrade for existing recycling extruders.

"ViscoZero technology is designed to produce recyclate for direct food contact, while giving maximum flexibility regarding input materials and high efficiency," said Gerhard Bräuer, product manager at Viscotec. "It can create a loop without a downward spiral for the recycling of post-consumer and post-industrial waste."

PP, PS, PS and HDPE recyclates are typically used in lower-grade applications - but ViscoZero can

overcome this. It can produce recyclates for high-value applications, from PET waste as well as polyolefins, says the company.

After the recycling extruder, input material is processed in ViscoZero in liquid form and under vacuum. When recycling PET waste, food-grade rPET pellets are produced in a few minutes. Both the increase in intrinsic viscosity (iV) and the decontamination of the material is done very quickly.

> [www.starlinger.com](http://www.starlinger.com)

Thorsten Kühmann, managing director of **VDMA** Plastics and Rubber Machinery, told delegates at K2022 that separate machines must increasingly communicate with one another. This is achieved using a 'global language' such as OPC UA.

At the show, around 40 companies from eight countries were running an OPC UA demonstration project, involving 85 machines. Each had an OPC UA logo and a QR code that visitors could scan with their smartphones. From here, they were taken to the UMATI internet platform, where they could see live data from each machine.

"For greater clarity, we installed a large dashboard in the VDMA Dome - where visitors could navigate each individual machine to see defined data," he said.

The most important factor, he said, is for "all machines to speak the same language and use the same system".

OPC UA implementation has already happened for core machinery such as injection moulding and extrusion - and is now being extended to areas such as particle foaming and ancillaries, he said.

"This includes temperature control units and hot runner units, or liquid silicone metering," he said. "This is the horizontal level. Machines next to each other in a production hall can communicate with each other."

Another strand is vertical networking to the MES

IMAGE: VDMA



**Above:**  
**Kühmann: "It's important that all machines speak the same language to one another"**



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**Right: Wacker's new additive masterbatches are used to modify biodegradable polyesters**

system that centrally processes a factory's data. And now the material flow is also included. Also at K2022, a new Material Supply System interface - OPC 40086-1 - was presented. This is a 'Release Candidate' - meaning it is conceptually ready but can still be added to and adapted.

However, he said that many processors are still cautious about OPC UA applications.

"They are worried that their data will not be handled carefully - and even that their competitors may gain access to it."

Part of the problem is that these data platforms have only been offered by individual companies or small consortia - which users do not trust. For this reason, VDMA is trying to establish a trustworthy, neutral platform that anybody can use.

It is important that we establish such a platform. Otherwise, we run the risk of big data providers taking over the whole thing - which is something no one in the industry wants," he said.

> <http://vdma.org/plastics>

**Wacker** showcased several new additive masterbatches for modifying biodegradable polyesters at K2022.

The products are pelletised polymer blends consisting of vinyl acetate-based polymer resins and polylactic acid. They have the same effect as pure vinyl acetate-based resins but are easier to handle and so easy to process.

Two of the grades - Vinnex LA 2540 and 2640 - are for the production of highly transparent, biodegradable films. Both grades increase melt strength, allowing optimised extrusion. With their higher melt strength, the two grades reduce the necking - constriction of the extrudate - that is observed in many biodegradable polyesters. In blown film extrusion, they stabilise the extruded polymer bubble, making high process speeds possible.



IMAGE: WACKER

The masterbatch carrier is a polylactic acid produced from renewable raw materials. The actual active component is the vinyl acetate-based polymer resin. The ready-to-process masterbatches have an active ingredient content of 40%, while the polylactic acid content is 60%. Grain size is around 3mm, allowing the dry blend to be smoothly dosed.

> [www.wacker.com](http://www.wacker.com)

**Below: W&H presented developments in efficient production, circular economy and digitisation at K2022**

**Windmüller & Hölscher (W&H)** presented new developments in three areas - efficient production, circular economy, and digitisation - during K2022.

A highlight was a Varex II blown film line that was in operation on the stand. Daily live machine demonstrations included the Easy2 Change assistance system - an 'autopilot' for product changes. Compared to an experienced operator, the number of necessary clicks for a product change is reduced by more than 70% and the time needed is cut by more than half - while ensuring that no errors are made.

This is especially important for difficult products, such as those containing recycled materials of varying quality.

After its appearance at the show, the line will be delivered to IsoFlex Packaging - part of the Sigma Plastics Group - in Nashville, Tennessee in the USA.

W&H also highlighted new packaging solutions for the circular economy - including six examples for recycling and four that use high percentages of recycled materials. All solutions were extruded and printed with W&H lines and have been tested for their practicability with W&H sack-making lines or with converting partners.

On four separate days of the show, W&H hosted an in-house event at its headquarters in Lengerich, where another 12 lines - including extrusion, printing, and converting machinery - were presented.

> [www.wuh-group.com](http://www.wuh-group.com)

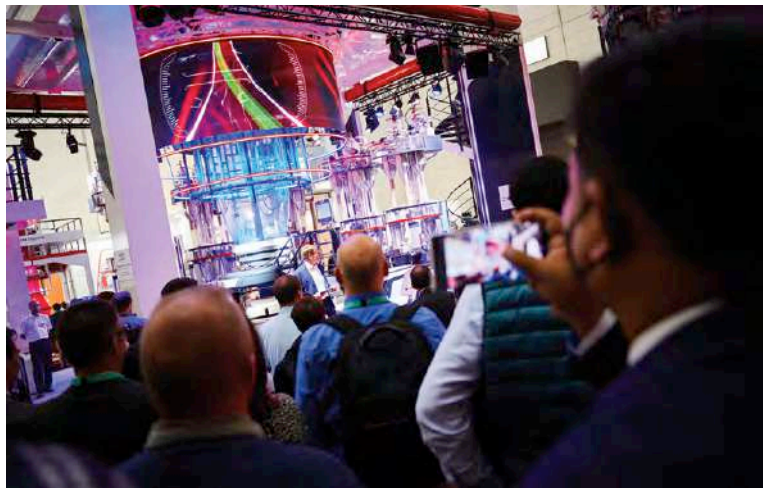


IMAGE: W&H

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# Clear path to better resin performance



IMAGE: MILLIKEN

## *Clarifying and nucleating agents play a key role in modifying semi-crystalline polymers, in particular polypropylene, enhancing physical properties and improving clarity. Mark Holmes reports*

Nucleating agents can make a real difference in many semi-crystalline polymers, including reducing processing cycle times and enhancing physical properties. They can also improve clarity and a whole subset of nucleators - clarifiers - are available that are optimised to make polypropylene (PP) transparent and improve light transmission.

Covid-19 has influenced the market for clarifying and nucleating agents in plastics, according to **NJC Europe**.

"The impact of Covid-19 has affected our daily lifestyle," said Hieu-Dinh Phan, sales and marketing manager at the company. "The increase of people working from home and growth of e-commerce has led to a higher demand for products such as DMDBS (3,4-dimethyl benzylidene sorbitol), particularly for food packaging. Take-away and food storage containers, grocery and online shopping all require packaging with important features such as stiffness, sustainability (light in weight and recyclability), clear aesthetics and affordability. Covid-19 has also led to a surge in applications for medical grade plastics - from nonwoven face masks to test vials and disposable syringes."

According to Phan, the main factors currently driving the market are still related to Covid-19 and the resulting global economic slowdown. "Cost-effective solutions in the clarified field are in high demand due to rising inflation and increased raw material costs for plastics wrapping and packaging, as well as medical applications," she said. "The main trends include affordable, environmentally friendly solutions, such as cost-effective energy saving propositions, as well as the circular economy with its ramifications across all of the polyolefins industry."

To meet demands for energy saving solutions, New Japan Chemical and NJC Europe have developed new clarifiers that perform at low temperatures. The two companies say the RikAFast EDX and EDXP products have been developed in close collaboration with partners in the PP industry to provide good price-performance benefits. In particular, the new grades address the shift to higher melt flow rate (MFR) resins, which are processed at lower temperatures than standard grades. They enable the clarifier and resin to form a solution at a relatively low temperature, yielding good haze values and improved aesthetics both in homopoly-

**Main image: Clarified PP offers environmental gains as well as improved product aesthetics**

mer and random copolymer polypropylene.

RiKAFast EDX is described as a high-performance sorbitol-based clarifier for PP homopolymer and random copolymer that imparts good clarity and improved aesthetics across a wide range of processing temperatures.

Applications include injection and blow moulded, as well as thermoformed, items such as packaging, housewares, food containers, cups, bottles and trays. The EDX grade can be used in concentrations of 0.18-0.4% in PP homopolymer and random copolymer, with a recommended processing temperature range of 190-240°C.

The EDX products are said to be compatible with all existing sorbitol-based clarifiers but not with newer nonitol chemistries. According to NJC Europe technical manager Esti Santamaria, the incompatibility of sorbitol and nonitol clarifiers can be a challenge as special cleandown and cross-contamination measures must be taken to avoid unwanted downtime.

### Changing demands

Growing demand for clarifiers is also being experienced at **Adeka Polymer Additives Europe**, which attributes this positive trend to the increased demand for ready-to-eat foods resulting from the expansion of e-commerce and changes in dietary habits due to the pandemic.

“In these applications, it is not only the transparency of the packaging that is important, but also its stiffness, sustainability and affordability,” according to Marie-Raphaël Morvillier, technical director at the company.

“Adeka’s clarifiers – ADK STAB NA-21 and NA-71 – offer many advantages by meeting these requirements to an elevated level with a good balance compared with other products on the market. For example, high stiffness enhancement enables production of thinner packages, which contributes to higher transparency and a reduction in resin. They also improve heat deflection temperature, enabling the use of packaging in high-temperature conditions such as hot-filling, microwaves and dishwashers,” she said.

Adeka adds that demand for lightweight thin-wall packaging with good shape stability is expected to increase and clarifiers can be used in such applications to enable carbon footprint reductions to be made. To meet this forecast market demand, Amfine Chemical Corporation in the US – a joint venture between Adeka Corporation and Mitsubishi Corporation – expanded production capacity for ADK STAB NA-71 at its manufacturing plant in Kentucky last year.

The ADK STAB NA-71 clarifying agent is designed for application in PP homo and co-polymers for transparent food packaging applications. It is suitable for thermoforming, blow moulding, and thin-wall injection moulding. The additive is FDA cleared for use in PP, with no restrictions in food type or conditions of use (A-H).

It is also thermally stable and generates no odour during processing.

In common with other Adeka nucleators and clarifiers, ADK STAB NA-71 is an organic phosphate salt-based product. It is said to be resistant to plate-out, exudation and migration, and the company

## SPI shapes up with clarified PP lids

Taiwanese thermoformed packaging producer **South Plastic Industry (SPI)** developed a clear, anti-fogging PP lid to replace OPS for its ready meal food packaging using Millad NX 8000 clarifier from **Milliken**.

Together with Milliken, the company developed an UltraClear PP resin formulation that met the performance and aesthetic requirements for ready meal packaging and for more demanding microwaveable meals. The formulation also provided some additional processing gains.

“By using Milliken’s additives, we are able to thermoform our products at a lower processing temperature, which allows us to reduce our energy use,” said Toshio Wang, president of SPI. “At the same time, these additives allow SPI to produce a thinner PP lid without affecting rigidity, which in turn helps to reduce plastic usage while increasing output.”

SPI now uses Milliken clarifiers in all its UltraClear PP packaging and says it plans to explore using the material in more food applications, including some that currently use PET.

➤ <https://southplastic.com/> ➤ [www.milliken.com](http://www.milliken.com)

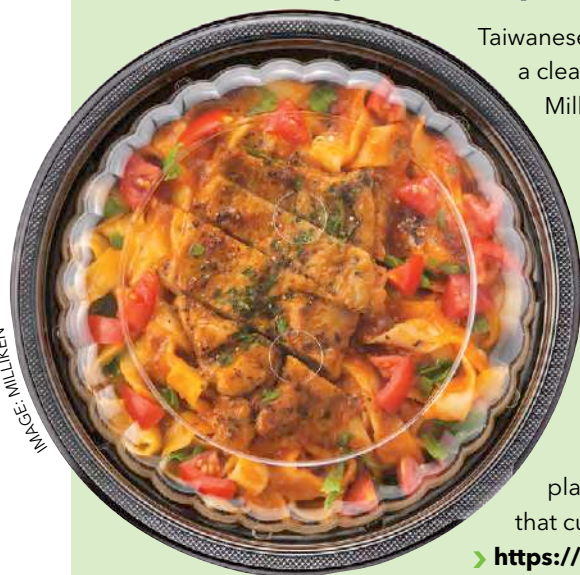


IMAGE: MILLIKEN

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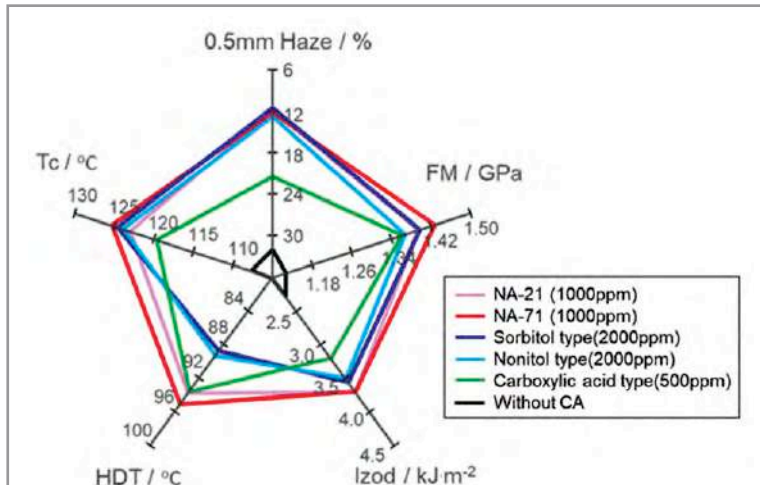


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**Figure 1: Spider chart comparing key performance attributes of Adeka's organic phosphate salt clarifiers against other commercially-available types**  
 Source: Adeka Europe

claims a better clarification effect at low concentrations and broader processing window than alternative sorbitol-type products. It is also said to provide a greater improvement in mechanical properties such as flexural modulus and HDT, making it suitable for high temperature, heat sterilised or hot-filled food packaging applications.

**Clear gains**

Ever-increasing demand for improving the optical, thermal and physical properties of polyolefins for use in packaging applications is driving demand for new plastics additive solutions, according to **Milliken**. The company claims that its additives are enabling more eco-friendly PP grades for packaging, while increasing inter-material replacement and meeting brand owner's goals of reducing environmental impact.

Minimising the carbon footprint of a packaged product can be accomplished in various ways, according to Milliken. A package can enable easier recycling through mono-material package design, for example. It may consume less energy during its manufacture than alternatives or may be more durable to reduce breakage and waste. By being thinner and lighter than other options, it can also be more eco-friendly to transport.

Milliken says that it has developed advanced plastics nucleator and clarifier additives that improve all these aspects of various polymers, but particularly PP. Millad NX 8000 ECO, for example,

delivers crystal-clear, glass-like clarity while extending sustainability benefits in the production of lighter-weight, clarified PP parts through shorter cycle times and lower processing temperatures (average energy savings of 10% are claimed).

In addition to delivering clarity, Millad NX 8000 ECO also maintains a consistent, fresh appearance under all retail lighting conditions, regardless of the presence of UV light from the light source. This is of growing significance as more retailers shift to LED lighting, which can impact how products look on the shelf.

Meanwhile, Milliken says its UL-certified Hyperform nucleators play a key role in allowing PP to produce packaging that is stronger, stiffer and highly recyclable - all without compromising on the final part's impact properties.

The growing adoption of the reusable packaging business model among brand owners is also driving the use of these types of additives, Milliken says. In contrast to the single-use model, reusable packaging designs must be durable yet still offer good transparency for easy refilling. Reusable packaging must also be stiffer and last longer to sustain its extended period of use - both requirements that be satisfied through the use of clarifiers and/or nucleators.

One well-known brand that has worked with Milliken to enhance its packaging circularity is Italian chocolatier Ferrero. The company asked Milliken to custom-develop more than 20 PP formulations to replace the long-established PS Ferrero Rocher box. During the course of the project, Milliken was able to demonstrate measurable performance improvements, including lower resource consumption and reduced greenhouse gas emissions, while meeting

Ferrero's demanding specifications and maintaining the box's transparency. "This project with Ferrero is a great example of how close collaboration can help to deliver value-added solutions," said Ruben Subira, regional market manager - plastic additives.

Milliken's Hyperform 909ei and Hyperform 500ei nucleators have been developed for production of thermoformed packaging that meets brand owner demands for better clarity and higher rigidity.

Traditional nucleating agents required customers to sacrifice impact to gain greater stiffness in thermoforming applications, according to Milliken. Hyperform 500ei enables thermoformed parts to deliver improved optics while



IMAGE: MILLIKEN

**Right: Milliken's Hyperform 500ei is targeted at thermoforming applications requiring improved optics, stiffness and impact performance**

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**Right: Nucleant PP 4000389-E from Ampacet improves mechanical properties and stiffness without affecting polymer density or transparency**

also offering high stiffness and maintaining good impact performance. The resulting thermoformed parts provide a clean and fresh look said to rival PET.

Hyperform 909ei is also designed for use by thermoformers in PP homopolymers. While it offers good aesthetics and a favourable balance of stiffness and impact properties, it has been developed with a simpler chemistry for food-contact applications that results in one SML (specific migration limit) less than the previous-generation product. Milliken says this is an advantage when developing products to meet European Union food contact regulations.

Masterbatch maker **Ampacet** has developed Nucleant PP 4000389-E, a nucleating additive that improves the mechanical properties and stiffness of injection moulded or thermoformed PP parts without affecting polymer density or transparency. It is said to allow downgauging of parts and end products while maintaining the same rigidity.

The company says that Nucleant PP is suitable for use in both virgin and post-consumer recycled resins and, because it does not alter the density of the polymer, it does not prevent flotation separation being used at recycling facilities so customers can meet sustainability goals. Suitable for opaque or transparent applications, Ampacet Nucleant PP is claimed to offer good optical properties, including improved clarity and reduced haze when used in transparent parts.

**Beta nucleation**

Nucleating agents are used in PP to improve a variety of physical and optical properties.

“The improved stiffness and strength of nucleated polypropylene and the faster achievable cycle times in moulding and extrusion leads to down-weighting and cost savings,” said Philip Jacoby, independent consultant and president of **Jacoby Polymer Consulting**.

“Nucleated polypropylene also exhibits higher heat deflection temperatures, allowing it to be used in more demanding, high temperature applications.”

Jacoby says that aside from greater clarity, reduced haze, enhanced strength and stiffness, and improved HDT, nucleation also results in reductions in cycle times and warpage and provides more uniform shrinkage. There is also a reduction in pigment sensitivity – different coloured pigments can result in significant and variable property changes – and processing can benefit in certain applications.

In recent years, high performance nucleating



IMAGE: AMPACET

agents have been introduced that achieve even better levels of clarity and stiffness, and further reduce warpage and shrinkage.

“Almost all commercially available nucleating agents nucleate the alpha crystal phase of polypropylene, which is the most common crystal form,” said Jacoby. “Another lesser-known crystal phase of polypropylene, referred to as the beta phase, has been known for over 50 years. There are nucleating agents that will produce high levels of the beta crystal phase during moulding or extrusion. This phase results in some interesting properties including higher impact strength and ductility, a lower melting point, and a tendency to undergo self-cavitation or micro-voiding when stretched in the solid state.”

In recent years, beta nucleating agents have been used to produce a number of products and have realised significant performance improvements. Jacoby says that examples include microporous, breathable films used in protective clothing, roofing membranes, and battery separator membranes.

Lighter weight and stronger thermoformed packaging is also possible through beta nucleation, including production of food containers that offer an opaque white appearance without the use of pigments due to the creation of micro voids.

“One limitation on the use of beta nucleation concerns the fact that they cannot be used if high levels of clarity and low haze are required,” said Jacoby.

“Nevertheless, the growing use of beta nucleating agents will continue to expand the markets and applications for polypropylene.”

**CLICK ON THE LINKS FOR MORE INFORMATION:**

- > [www.njceurope.com](http://www.njceurope.com)
- > [www.adeka-pa.eu](http://www.adeka-pa.eu)
- > [www.milliken.com](http://www.milliken.com)
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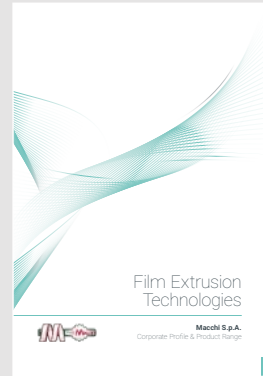
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In this brochure, Taiwan-based Diing Kuen provides all the specifications of its blown film technology to produce mono, two, three and five layer films. The film lines are divided into four categories: HTRL horizontal top rotating; EBLR vertical top rotating; BFL fixed; and other types.

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In this brochure, Improving the Efficiency and Quality of Polyolefin Extrusion, Chemours explains how issues including melt fracture and extrusion instabilities can be addressed with its Viton FreeFlow products, the next generation of polymer processing aids.

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## POLYSTAR: PLASTICS RECYCLING



Recycling Made Simple is the brochure from Polystar where you can find information about all of the company's plastics recycling systems. Its Repro Flex lines can recycle post-industrial and post-consumer PE/PP packaging and PP raffia/woven materials.

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## LMI Packaging

<b>Head office:</b>	Pleasant Prairie, Wisconsin, USA
<b>CEO:</b>	JP Moran
<b>Founded:</b>	1967
<b>Ownership:</b>	Private
<b>Employees:</b>	Around 150
<b>Profile:</b>	LMI Packaging was founded in 1967 by Chester Sykes, who recognised the potential of die cut lidding in the US. He converted a used letterpress into an in-line die-cutting machine. Since then, the company has expanded beyond lidding into pressure-sensitive labels. It supplies both types of product to a variety of markets - including food, beverages, health & beauty and household products. Its services include printing and die-cutting.
<b>Product lines:</b>	The company produces three types of lidding: die-cut, daisy chain and rollstock. LMI's in-house plate-making capabilities ensure it can design and cut lids to match any size of container. It also offers rim embossing. Daisy chain lidding solutions are for high-speed fill and seal packaging lines. They are connected by their tabs to create a single, continuous row that can be cut in the tab area after application. Rollstock lidding is produced in a web format on wound rolls - to be cut on packaging machinery. These are available in a number of widths and roll diameters.
<b>Factory location:</b>	The company makes all its products at its 72,000 sq ft facility in Pleasant Prairie, Wisconsin - though is looking to move to larger premises after seeing business double over the last two years. The company recently incorporated Vetaphone surface treatment equipment to its flexographic presses - in order to improve the quality of its label printing.

To be considered for 'Extruder of the Month', contact the editor on [lou@filmandsheet.com](mailto:lou@filmandsheet.com)

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The next issues of Film and Sheet Extrusion magazine will have special reports on the following topics:

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Materials testing/QC  
Agricultural film  
Medical materials/applications

### March 2023

Thermoforming  
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Editorial submissions should be sent to Lou Reade: [lou@filmandsheet.com](mailto:lou@filmandsheet.com)

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## Film and Sheet November 2022

The most recent issue of Film and Sheet Extrusion magazine has a cover story that explores recent developments in the sheet sector. The November edition also has features looking at thin-wall packaging, plastics in construction and smart packaging.

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## Film and Sheet October 2022

The October issue of Film and Sheet Extrusion takes a look into the world of plastics recycling technology, with other features covering extrusion machinery and biax film. Plus there are previews of K2022 materials and AMI's Plastics Extrusion World Expo North America.

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## Compounding World December 2022

The Compounding World December issue has a cover feature on flame retardants, the latest products and new market developments. Plus anti-counterfeiting additives, laboratory compounders and materials testing and a review of K2022.

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## Plastics Recycling World November/December 2022

This edition of Plastics Recycling World takes a look at the latest PET recycling equipment that was on show at K2022 in Germany. It also explores new EU regulations on food contact process authorisation and reviews progress in chemical recycling.

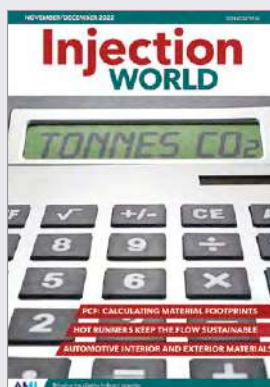
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## Pipe and Profile November-December 2022

The November-December of Pipe and Profile Extrusion investigates how formulations with high recycled content are making wood-plastic composites more sustainable. Other features look at what's new in pipe joining and batch mixing, plus there is a review of K2022.

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## Injection World November/December 2022

The November/December edition of Injection World magazine looks at the fast emerging area of Product Carbon Footprints. It also explores developments in hot runners and automotive plastics, plus a review of key news from October's K exhibition.

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	<b>1-5 February</b>	PlastIndia, New Delhi, India	<a href="http://www.plastindia.org">www.plastindia.org</a>
	<b>28-30 March</b>	Plastic Print Pack Nigeria, Lagos, Nigeria	<a href="http://www.ppp-nigeria.com">www.ppp-nigeria.com</a>
	<b>28-30 March</b>	Expo Plasticos, Guadalajara, Mexico	<a href="http://www.expoplasticos.com.mx">www.expoplasticos.com.mx</a>
	<b>17-20 April</b>	Chinaplas, Shenzhen, China	<a href="http://www.chinaplasonline.com">www.chinaplasonline.com</a>
	<b>4-10 May</b>	Interpack, Dusseldorf, Germany	<a href="http://www.interpack.com">www.interpack.com</a>
	<b>23-26 May</b>	Plastpol, Kielce, Poland	<a href="http://www.targikielce.pl/en">www.targikielce.pl/en</a>
	<b>30 May-2 June</b>	Equiplast, Barcelona, Spain	<a href="http://www.equiplast.com">www.equiplast.com</a>
	<b>5-8 September</b>	Plast 2023, Milan, Italy	<a href="http://www.plastonline.org/en">www.plastonline.org/en</a>
	<b>26-28 September</b>	Interplas, Birmingham, UK	<a href="http://www.interplasuk.com">www.interplasuk.com</a>
	<b>17-21 October</b>	Fakuma, Friedrichshafen, German	<a href="http://www.fakuma-messe.de">www.fakuma-messe.de</a>
	<b>7-10 November</b>	Plastimagen, Mexico City, Mexico	<a href="http://www.plastimagen.com.mx">www.plastimagen.com.mx</a>
<b>8-9 November</b>	Plastics Extrusion World Expo USA, Cleveland, USA	<a href="http://www.extrusion-expo.com/na/">www.extrusion-expo.com/na/</a>	
<b>28 Nov-2 Dec</b>	IPF Japan 2023, Chiba, Japan	<a href="https://www.ipfjapan.jp/english/">https://www.ipfjapan.jp/english/</a>	


## AMI CONFERENCES

<b>13-14 December 2022</b>	Recycling Flexible Packaging, Cologne, Germany
<b>31 Jan-2 Feb 2023</b>	Polyethylene Films North America, Orlando, FL, USA
<b>22-23 February 2023</b>	Stretch & Shrink Film Asia, Bangkok, Thailand
<b>6-8 March 2023</b>	Agricultural Film Europe, Barcelona, Spain
<b>20-22 March 2023</b>	Plastic Pouches Europe, Barcelona, Spain
<b>18-20 April 2023</b>	Stretch & Shrink Film Europe, Valencia, Spain
<b>20-21 June 2023</b>	Thin Wall Packaging North America, Chicago, USA
<b>15-16 August 2023</b>	Agricultural Film North America, Houston, USA
<b>26-28 September 2023</b>	Biax Film Europe, Brussels, Belgium

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