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Film and Sheet EXTRUSION

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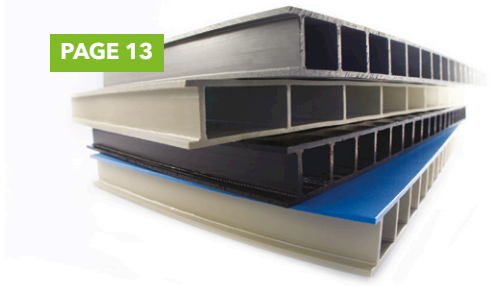

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Bringing the global plastics industry together

USA keeps strong links with its Nafta partners

The USA's closest neighbours – Canada and Mexico – remained its largest trading partners in plastics last year, despite the uncertainty of the renegotiation of the North American Free Trade Agreement (NAFTA) in 2017.

In its annual Global Trends report, the Plastics Industry Association released figures for the whole of 2017 – which it says "paints a complex and ultimately positive portrait of the US plastics industry".

"The report shows that the US plastics industry continues to innovate its way into new applications and new markets," said William Carteaux, the organisation's president and CEO.

The report showed that US plastics companies exported $15.7 billion to Mexico and $12.5 billion to Canada in 2017. The US also maintained the largest trade surplus – $10.6bn – with Mexico, as it did in 2016.

Overall, while the US plastics industry trade surplus decreased by nearly 40% in 2017 – from $4.8bn in 2016 to $2.9bn in 2017 – demand was up across the board: apparent consumption of plastics industry goods increased by 6% in 2017, which outpaced growth in US plastics industry shipments overall. The decline in the industry's trade surplus was driven by a 9.3% increase in imports.

Perc Pineda, chief economist at the organisation, said: "A shrinking trade surplus in this instance shows how in-demand the products and services of plastics are in the US. Our estimates show that in 2017 the plastics industry global trade volume increased 9.5% from 2016."

› **www.plasticsindustry.org**

Acquiring cleanroom expertise

US-based Tekni-Plex has acquired Beyers Plastics of Belgium – a cleanroom Class 7 extruder and converter of polyethylene (PE) film – from investment company Famo. Beyers will now join Tekni-Plex's Tekni-Films business unit. It specialises in PE packaging for pharmaceutical, medical and other industries such as food, aerospace, and chemicals.

The acquisition will help Tekni-Plex to expand its portfolio of cleanroom-produced pharmaceutical and medical flexible packaging products.

www.tekni-plex.com

NEWS IN BRIEF...

Nordson has begun work on a new 'global hub' for its extrusion and fluid coating die business, which it says will "redefine the way dies are built". The 145,000 sq ft (13,500 sq m) facility will be located in an industrial park near three existing Nordson sites in Chippewa Falls, USA. Relocation of existing operations to the new facility will begin in summer 2019 and be complete by late 2020.
www.nordson.com

Perstorp is to expand capacity of its Pevalen non-phthalate polyester plasticiser from 2019. To do this, it has entered into a long-term agreement with Alcoplast of Italy, which will more than double the current production capacity to 50,000 tonnes/year and improve unit metrics via economies of scale.
www.perstorp.com

Augmented reality for consumer packaging

Constantia Interactive allows access to digital information on packaging via a smartphone or tablet

Packaging giant Constantia Flexibles has recruited Wikitude as a technology partner to develop a new 'augmented reality' (AR) design tool for consumer packaging.

The tool, called 'Constantia Interactive' uses software developed by Wikitude that allows customers to access digital information on a product via a smartphone or tablet.

"According to a survey we carried out, 69% of buyers would rather choose a product for which they can call up useful additional information with their smartphone," said Alexander Baumgartner, CEO of Constantia Flexibles: "With Constantia Interactive, as soon as the smartphone camera detects the innovative product packaging, additional information about ingredients, instructions for use or interactive marketing campaigns appear."

› **www.cflex.com** › **www.wikitude.com**

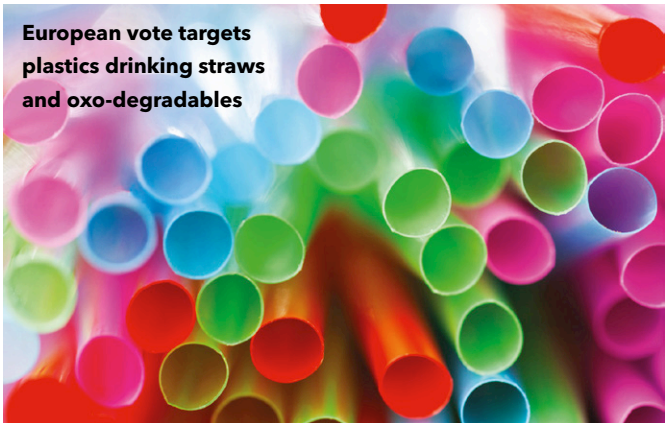
Europe adopts plan to ban single-use plastics

The European Parliament has voted to adopt draft plans to ban the use of single-use plastic items, such as plates, cutlery, straws, balloon sticks and cotton buds, across the EU from 2021. The move is driven by concern over marine litter, which MEPs said is comprised of 80% plastic.

The draft plans also include a ban on products made from oxo-degradable plastics and EPS fast food containers. Member states will have to reduce consumption of other items for which no alternatives currently exist by least 25% by 2025 (including single-use burger boxes, sandwich boxes, and containers for fruit, vegetables, desserts and ice creams).

They will also be asked to draft national plans to encourage the use of products for multiple use, re-use and recycling.

Other plastics, such as beverage bottles, will have to be collected separately and recycled at a rate of 90% by 2025. Waste from plastic cigarette filters will have to be reduced by 50% by 2025 and 80% by 2030, while member states must also ensure that at least 50% of lost or abandoned plastic fishing gear is collected each year, with a recycling target of at least 15% by 2025.



European vote targets plastics drinking straws and oxo-degradables

PHOTO: SHUTTERSTOCK

"We have adopted the most ambitious legislation against single-use plastics. It is essential in order to protect the marine environment and reduce the costs of environmental damage attributed to plastic pollution in Europe, estimated at €22bn by 2030," said rapporteur Frédérique Ries, MEP.

Plastic packaging association Europen said it supports "measures that address the problem of plastic pollution effectively, that are harmonised and implementable by member states and industry". However, it repeated its concerns that certain elements of the resolution "have not been adequately examined and might not achieve [their] objectives".

In particular, Europen Managing Director Virginia Janssens, expressed concern over the proposed removal of internal market safeguards for measures that cover packaging items.

› **www.europarl.europa.eu**
› **www.europen-packaging.eu**

Cabot ABS aimed at ESD trays

At this year's Fakuma, Cabot introduced a new electrically conductive ABS compound for production of thermoformed trays for ESD applications.

The new Cabelec CA6483 grade has been developed to meet growing demand for ABS in the electronics manufacturing sector, where it offers improved thermal stability over current PS options as well as "warmer" haptics. The grade offers a surface resistivity of around 8,000 ohm/sq.

It is not easy to make a conductive ABS because of the dispersed rubber component, according to Damien Even, Technical Sales and Development Support Manager at Cabot Performance Materials Belgium. "You have to use a special carbon black and have the right formulation."

FSE will cover more Fakuma news in its next issue.

› **www.cabotcorp.com**

Boosting the recovery of PE film waste

Repsol and Saica Natur have signed an agreement to boost the use of low density polyethylene (LDPE) film waste.

With the project, they intend to develop new polyolefins that use recycled material, with a special goal to ensure quality consistency for more demanding applications. The agreement falls under the Reciclex project, a Repsol's initiative to promote the recyclability of its materials.

"In an environment increasingly oriented to the circularity of resources, film waste recovery is a challenge and a business opportunity," said Roberto Gómez, circular economy manager at Repsol's chemicals division. "The aim of this agreement is to offer new materials that meet the demanding requirements of the film market."

The project will combine Saica Natur's expertise as a waste manager and a producer of recycled LDPE pellets, with the capabilities of Repsol's technology centre in Spain. The agreement falls under the Reciclex project, a Repsol initiative to promote the recyclability of its materials.

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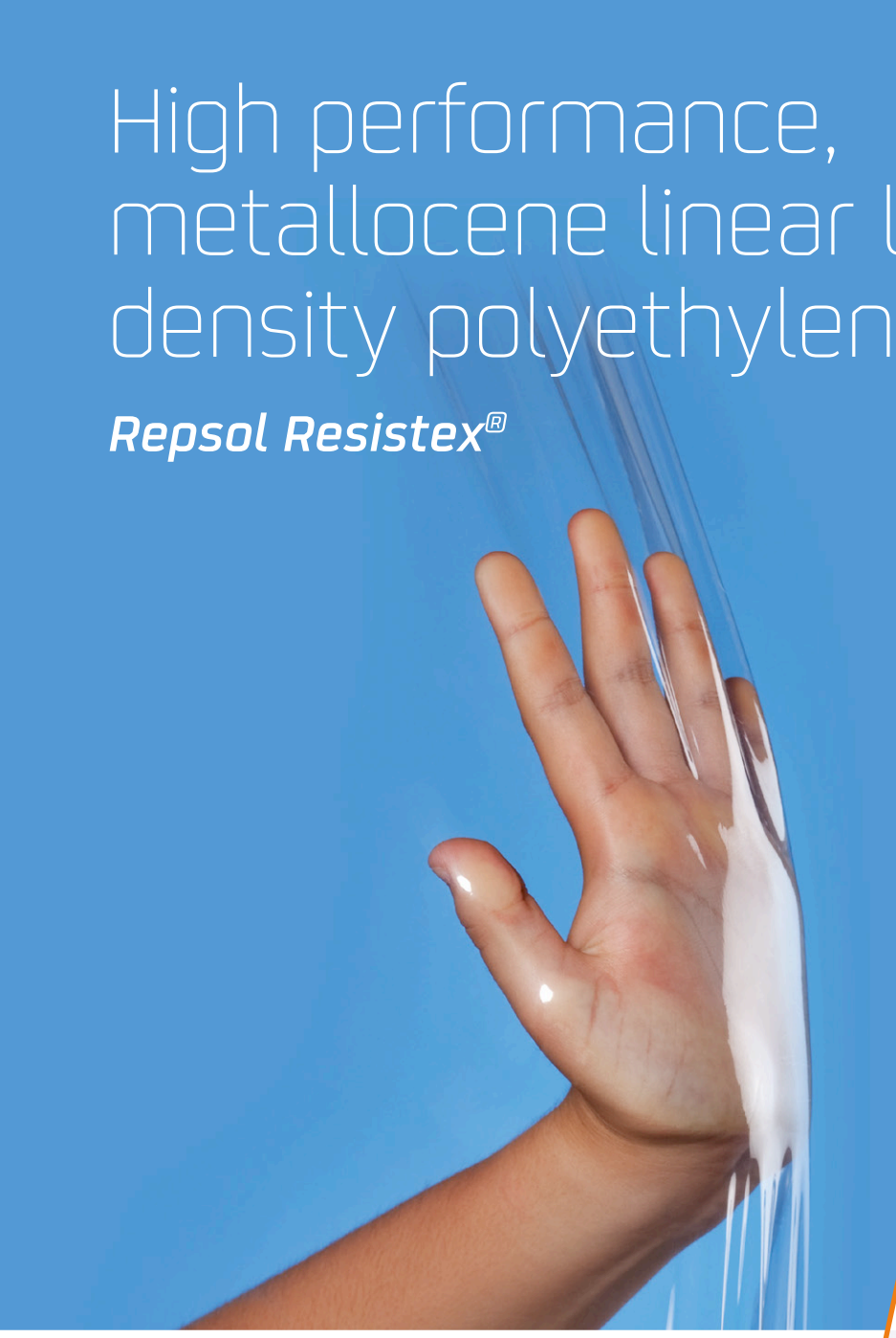

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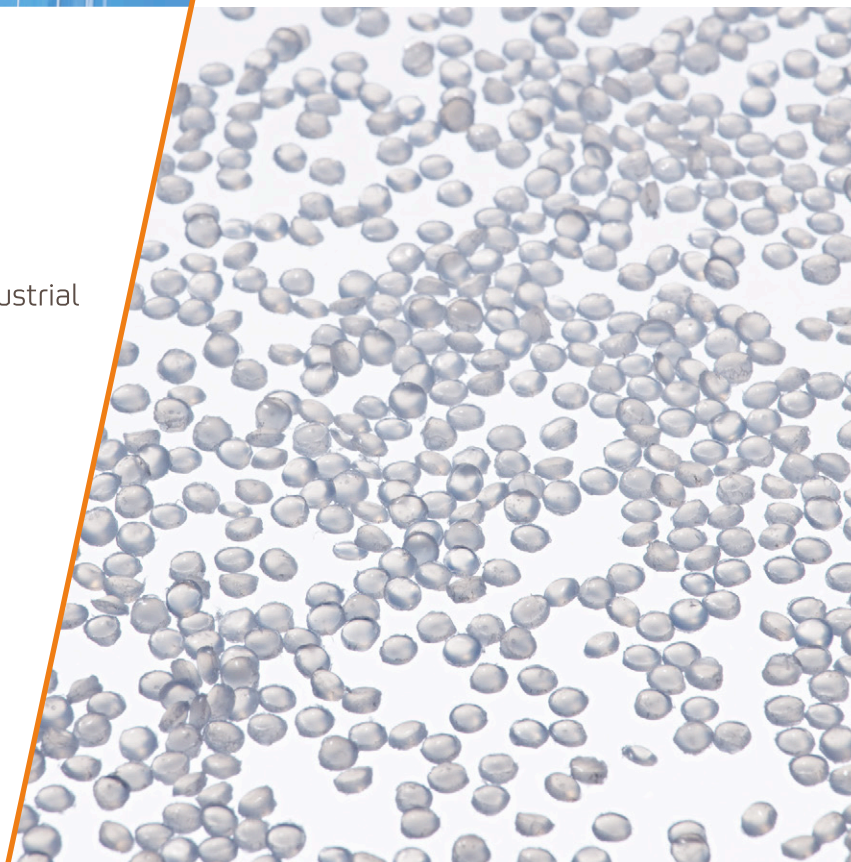

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More companies sign up for Cleveland plastics tradeshows

More than 140 companies have now booked booths for the major new free-to-attend plastics industry exhibition that will take place at Huntington Convention Center in downtown Cleveland, Ohio on May 8-9, 2019. Organised by AMI, the event will include three focused tradeshows – the Compounding World Expo, the Plastics Extrusion World Expo and the Plastics Recycling World Expo.

The latest companies to join the growing list of exhibitors at the three expos include Alpha Marathon, Bekaert, Cloeren, Gneuss, Heritage Plastics, Heubach, KraussMaffei Berstorff, Lanier Color, Maag, Maguire, Oden Technologies, Omipa, Pallmann, Paramount Colors, Schenck, Thermo Fisher Scientific and Vecoplan.

PHOTO: HUNTINGTON CONVENTION CENTER

The Huntington Centre will host the free-to-attend plastics shows expos in 2019

They join an impressive list of existing exhibitors including Addex, Advanced Blending Solutions, Azo, B&P Littleford, Beier, Brabender, Buss, Cabot, Chemours, Clariant, Coperion, CPM Extrusion, Cumberland, Davis-Standard, Dr Collin, Dover Chemicals, Entek, Farrel Pomini, Ferro, JSW, Konica Minolta, Leistritz, Macchi, Milliken, Mixaco, Modern Dispersions, NFM, NGR, Nordson, Omya, PTI, Reifenhäuser, Starlinger, Struktol, Toyota Tsusho, Wacker, Windmöller & Hölscher, Zeppelin, Zoltek and many more.

"More than half of the booths have already been reserved and new bookings are coming in daily," said Rita Andrews, head of exhibitions at AMI. "We are confident that this is going to be the biggest plastics industry event in North America next year".

The Cleveland expos will feature five free-to-attend conference theatres, plus there will be a networking party for attendees and exhibitors at the Rock and Roll Hall of Fame on the evening of May 8. Online registration for tickets will go live on November 26, and you can register your interest in advance at the website listed below.

Exhibitor prices start at $3,400 for a 100 sq ft booth including unlimited exhibitor passes and free international publicity before the show. Complete stand packages including furniture and electrics start at $3,800 for 100 sq ft.

For more information on exhibiting at the Compounding World Expo 2019, the Plastics Extrusion World Expo 2019 and the Plastics Recycling World Expo 2019, please visit: **https://www.ami.international/exhibitions**

Euromap working group drafts standards for networking of extrusion machinery

Euromap has published draft standards governing the networking of extrusion machinery.

The Euromap 84 working group deals with the standardization of OPC UA based interfaces for extrusion. Experts from 10 European extruders and extrusion line manufactures are working with control systems manufacturers and MES suppliers on standardised information models to allow extrusion lines to be networked to central computers/MES. They also allow networking within the extrusion line itself. As with all Euromap recommendations, they are manufacturer-neutral.

First, basic specifications will be made, then the extrusion line will be modelled as a whole. This helps to control overall production (such as throughput, product quality and energy consumption). For managing production jobs, a new concept was needed because the existing model – for injection moulding – could not be transferred to extrusion. Next, the various components of an extrusion line will be examined separately to record all important process parameters.

The drafts of seven parts – which includes haul-offs, melt pumps and filters, in addition to extruders and extrusion lines – have now been published. They will be validated in test implementations before being published as final versions. Additional parts for further components of an extrusion line are in preparation, says Euromap.

› **www.euromap.org/euromap84**

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Italian machinery imports on the rise in first half of 2018

Italian imports of plastics and rubber processing machinery grew by 23% in H1 2018 compared to the same period last year while exports edged only fractionally up. This meant the trade balance fell by 7% and is attributed to "the lacklustre performance heralded in the early months of the year", according to the country's plastics and rubber machinery trade association Amaplast.

The plastics machinery industry was still over €1bn in the black in total, but €14m in the red for injection moulding machinery. "The dynamism of purchases from abroad may be interpreted as renewed faith in the domestic market, mainly due to investment incentives that are likely to be renewed and naturally hoped for by businesses in the industry," Amaplast said in its analysis.

Strongest growing import sectors included injection moulding machines (+31%), blow moulding machines (+75%), flexographic printers (+111%) and moulds (+12%). This was driven mainly by strong demand from the packaging sector, which grew by 14% last year and has continued on a strong growth path in 2018.

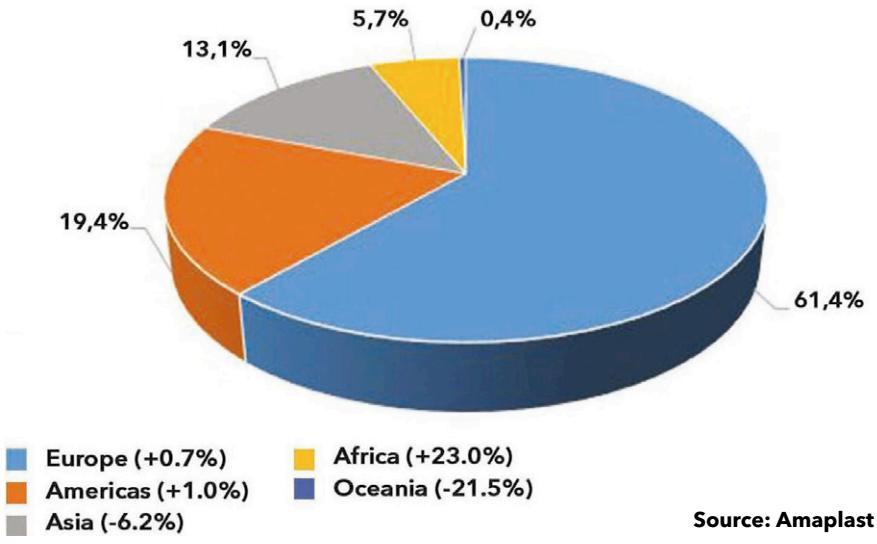
Amaplast said Germany remains the largest exporter of plastics machinery to Italy and widened its lead over China in H1.

Europe remains the largest export market for Italy's plastics machinery firms, accounting for 61% of the total, although export sales were static year-on-year. The NAFTA countries were in second place and saw a 7% increase in sales. Russia, which had a very strong 2017, saw a major decline. Sales to Asia, Oceania and the rest of Latin America were down.

According to Amaplast president Alessandro Grassi, its members' July order books were stable to slightly up on both June 2018 and July 2017. "This gives us reason to hope for a rebound in production and exports in the last quarter of the year," he said.

› **www.amaplast.it**

Italian plastics machinery exports by destination (% share and Δ% H1 2018/H1 2017)



Source: Amaplast

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As well as shifts in ownership, the plastic sheet business has seen a commitment from European producers to boost the amount of recyclate in their products. Lou Reade reports

Forging ahead in sheet

There have been some seismic shifts in the plastic sheet market recently – with a number of businesses divesting their interests and handing over to a new set of players. Acrylic sheet manufacturer **Plaskolite**, for instance, says it has become the largest manufacturer of acrylic and polycarbonate sheet manufacturing in North America – following a number of recent acquisitions.

Most recently, it bought the North American polycarbonate sheet business of **Covestro**. The exact price of the deal was not revealed, but Covestro said that both companies "agreed on a purchase price in the high-double-digit million US dollar range". For Covestro, the divestment is part of a wider strategy to exit the polycarbonate sheet business worldwide, and it plans to divest both its European and Asia-Pacific subsidiaries.

As part of the US transaction – which completed in August of this year – Plaskolite acquired sheet headquarters, production sites and warehouse facilities in Sheffield, Massachusetts and will maintain an existing third-party distribution warehouse facility in Hebron, Ohio. Plaskolite says that the acquisition now takes its employee numbers to more than 1200 worldwide.

"This acquisition changes the landscape of the plastics industry in North America," said Mitchell Grindley, Plaskolite's president and CEO. "We are the only manufacturer to offer a complete clear sheet product portfolio, including acrylic, polycarbonate, PETG and ABS."

Plaskolite has since launched its Tuffak range of polycarbonate sheet – which was formerly known as Makrolon. As part of its acquisition of Covestro's polycarbonate sheet business, Plaskolite secured the Makrolon product line – and use of the Makrolon name for a limited time. Tuffak is the new name for the range. The product itself and all the manufacturing processes to make it will remain the same.

Tuffak polycarbonate sheet is used in interior windows, automotive parts, security glazing, sign and lighting and other applications requiring a combination of strength and light weight, says the company.

"The addition of the polycarbonate sheet business and the introduction of the Tuffak brand further expand Plaskolite's portfolio of plastic sheet solutions," said Mitchell Grindley, president and CEO of Plaskolite. ›

Main image: Plaskolite's Optix-L sheet (called LuciteLux, when it was owned by Lucite International) was used to make these animal figures at the COP21 climate conference in Paris in 2015

Acrylic expansion

Covestro's sheet business is one of several recent Plaskolite acquisitions: in 2016, it acquired Rotuba's profile lighting business, while earlier this year it bought the continuous cast acrylic business of Lucite International – including general-purpose, sanitary ware spa and bath sheet.

This latest transaction includes Lucite's 93,000 sq ft sheet manufacturing facility in Memphis, Tennessee. Terms of the deal were not disclosed.

The two companies have had an ongoing business relationship for 40 years, with Plaskolite buying acrylic monomers from Lucite – part of Mitsubishi Chemical Corporation. Plaskolite's customised products are used in a variety of applications including windows, doors, lighting, signs, point-of-purchase displays and bath products.

"Our goal is to be the industry leader while strengthening our marketplace position," said Mitchell Grindley, Plaskolite president and CEO.

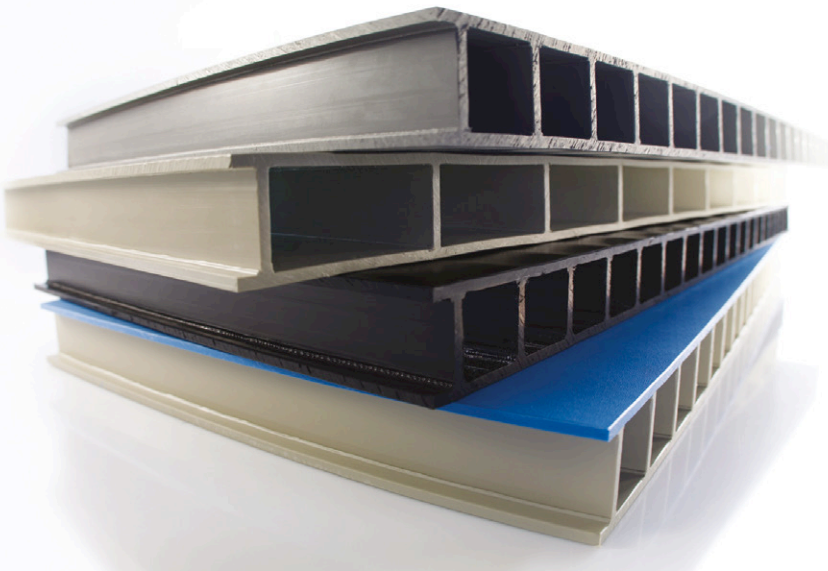
Following the acquisition, Plaskolite will employ 800 people in North America – at six US plants and one in Mexico.

Meanwhile, **Mitsubishi Chemical Corporation** (MCC) of Japan is selling its European acrylic (PMMA) sheet business to Schweiter Technologies of Switzerland. MCC will sell the business – based in the UK, and operated by Lucite International UK (LIUK) – for £92m (US$102m) – which includes a production site in Darwen, Lancashire in the UK, as well as Perspex Distribution, the local sales company for LIUK's acrylic sheet. Last year, the UK operation had sales of around £126m (US$164m) and employed 330 people.

Schweiter is a leading producer of plastic sheet in Europe, especially in PMMA. It has also bought MMA monomer – the raw material used to make PMMA sheet – from MCC for many years.

The transfer of MCC's European PMMA sheet business to Schweiter "will enhance the partnership, based on a continued supply of MMA monomer, as Schweiter expands its business in the European market", said MCC.

Below: Simona's sheet portfolio includes a range of twin-wall products



Simona sticks with sheet

Simona of Germany is holding firm to its own sheet assets – and looking to expand it further – following an overall 10% leap in profitability in the first half of this year, despite a relatively modest growth in sales revenue.

Sales in the company's semi-finished parts division rose by 2.5% to exceed €165m (US$192m) in the first half. PVC sheet products for the aviation sector and high-performance plastics expanded significantly in the first half. The market for foamed PVC sheets for applications in the printing and advertising industry remained highly competitive, said Simona.

"The quality of our bottom-line result is encouraging," said Wolfgang Moyses, CEO of Simona. "We improved at an operating level and lifted EBIT significantly. We anticipate we can meet our revenue target of €405-410m – and EBIT margin target of 7-9% – for 2018, despite the fact that the second half of the year tends to be weaker due to seasonal effects."

Simona also extended its presence in the US by acquiring Premier Material Concepts (PMC), which manufactures plastic sheet for use in caravan, agricultural, and industrial applications. Employing more than 60 people, the company generated around US$27m (€23m) in 2017.

"PMC allows us to extend our product offering and strengthens our position in the US plastics market," said Larry Schorr, CEO of Simona America. "In addition, it gives us access to materials for thermoforming applications and underpins our strategic ambitions when it comes to diversifying our sheet business."

PET promise

PET Sheet Europe – a sector group of European Plastics Converters (EuPC) – says that collection of used PET food containers is preferable to setting reduction targets.

The European Union's Single Use Plastics Directive Proposal is now being assessed by the European Parliament. It includes a proposal to reduce the consumption of PET trays.

However, PET Sheet Europe says that PET trays are highly recyclable, and already contain a high amount of recycled content – which has been increasing for some years.

Trays made of PET sheet are used in many

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Above: Archibald: "We take skeletal waste, reprocess it and return it to the original sheet manufacturer"

applications, ranging from fresh food and dairy to blister packaging and medical packaging.

EuPC says that members of PET Sheet Europe already use an average of 45% of recycled material in their products. However, it admits that more work needs to be done: separate collection of trays and other PET sheet-based products is hampered by non-binding targets, for instance – so increasing collection rates is very important.

At the same time, PET Sheet Europe has made a commitment to the European Commission that it will raise the average recycled content of its products to 70% by 2025.

One PET Sheet Europe member, **Coexpan**, has already signalled its commitment to the target: it says that it currently uses around 50% recycled material in its products – rigid PET sheets primarily for packaging foodstuffs, household products and personal hygiene products.

"The future of packaging poses major challenges for our society," said Dinis Mota, CEO of Coexpan. "Our commitment is to design optimal and sustainable packaging solutions that guarantee the preservation and protection of products and ensure the responsible use of our natural resources."

The company has three European production plants located (in Spain, Italy and Germany) that specialise in extruding PET-based and rPET-based sheet for food packaging and industrial applications. Two other plants, both in France, specialise in thermoformed packaging that produce trays and other rPET-based products for food packaging.

Finding recyclate

Plastics recycling specialist **Vanden** has launched a scheme that it says will help UK sheet manufacturers find new, reliable sources of high-quality recycled plastic – which can be used to make new sheet, and boost the proportion of recycled content.

The scheme looks to the sheet manufacturers' client base for this recyclate, rather than relying on virgin PP or PET.

"Manufacturers and printers who make products from sheet plastic always end up with skeletal waste," said Scott Archibald, business development manager at Vanden. "While the skeletal waste is often separated and sent for recycling, it could end up anywhere. Under our new scheme, we are taking that same skeletal waste, reprocessing it and then returning it to the original sheet manufacturer."

There are two entry points for the scheme, says Vanden: via the sheet manufacturer or via the card producer. If instigated by the sheet manufacturer, Vanden will identify which clients can produce the most viable skeletal waste, test the material and then put in place a closed-loop collections, reprocessing and delivery programme. If instigated by the card producer, Vanden will test the waste and then approach the sheet producer to discuss whether the material can be used in the current production process.

Roll-stack boost

At this year's Antec conference, Peter Rieg – sales manager for packaging at **Battenfeld-Cincinnati** – explained how his company has boosted the

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Performance on the crest of a wave

One craft on the Route du Rhum race – which involves boats racing from France to Guadeloupe – has benefited from Altuglas sheet from **Arkema**.

The Arkema Multi50 trimaran, skippered by Lalou Roucayrol, uses high-performance, lightweight Altuglas ShieldUp polymer for the cockpit's windows and the protective bubbles of the two wheelhouses.

Arkema says it is the only material capable of withstanding the deforming and distorting effects of the boat's movements, while resisting the violent impact of waves and bad weather. It comes with a 10- year warranty against yellowing caused by UV rays. The performance and speed of the trimaran were improved, thanks to the weight gains provided by material: a window thickness of 6-8mm is enough with this polymer, while polycarbonate requires 12mm thick windows, says Arkema.

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output of sheet made from amorphous and semi-crystalline materials, with a new roll-stack design.

"While amorphous materials like HIPS and A-PET are not sensitive to cooling parameters, the quality of sheet made of semi-crystalline polymers like PP and PE has a great dependency on their cooling history," he said.

Modern extruders can handle the throughput, but cooling the sheet quickly enough to maintain quality is difficult. Running the polymer through cooled steel belts can boost quality compared to conventional calendaring, but is has output restrictions – while the short lifetime of the belts raised production costs, he said. A prototype with multiple cooling rolls also showed no improvement.

The company developed three design principles for the design of a new roll-stack:

Multi-nipping: higher line speeds were found to drag more air between the rolls and sheet, which reduced heat transfer efficiency – but nipping the rolls together prevented this;

Micro-melt bank: in conventional calendaring, heat within the sheet melts the already calibrated surface to create heat pockets or orange skin, but applying a line pressure to the sheet recalibrates the surface; and,

Equal cooling length: multiple small rolls will cool sheet gradually – on both sides – compared with the large roll diameters used in the past.

Some of the positive results of the system included: reduced warping and stress – with sheets showing no 're-curls' when placed on the floor, a clear sign of low internal stress; better transparency – with homo-PP sheet produced at twice the line speed, as the crystallisation point is reached more quickly due to the improved cooling efficiency; lower crystallinity, which was confirmed by microscopic analysis showing large areas in the conventional sheet and only small areas in the multiple-nip processed sheet; and, sheet thickness tolerances – the multiple calibrations maintain surface quality and also reduce crosswise variation considerably, which results in large material savings for some thermoformed articles.

"Using this system at line speeds up to 120 m/min, with multiple nips closed, a significant reduction of the crosswise thickness tolerances can be obtained," said Rieg.

Future research includes testing a wider variety of polymers – and some early results show that thinner gauge PP for lidstock can be produced with both sides glossy and good thermoforming behaviour.

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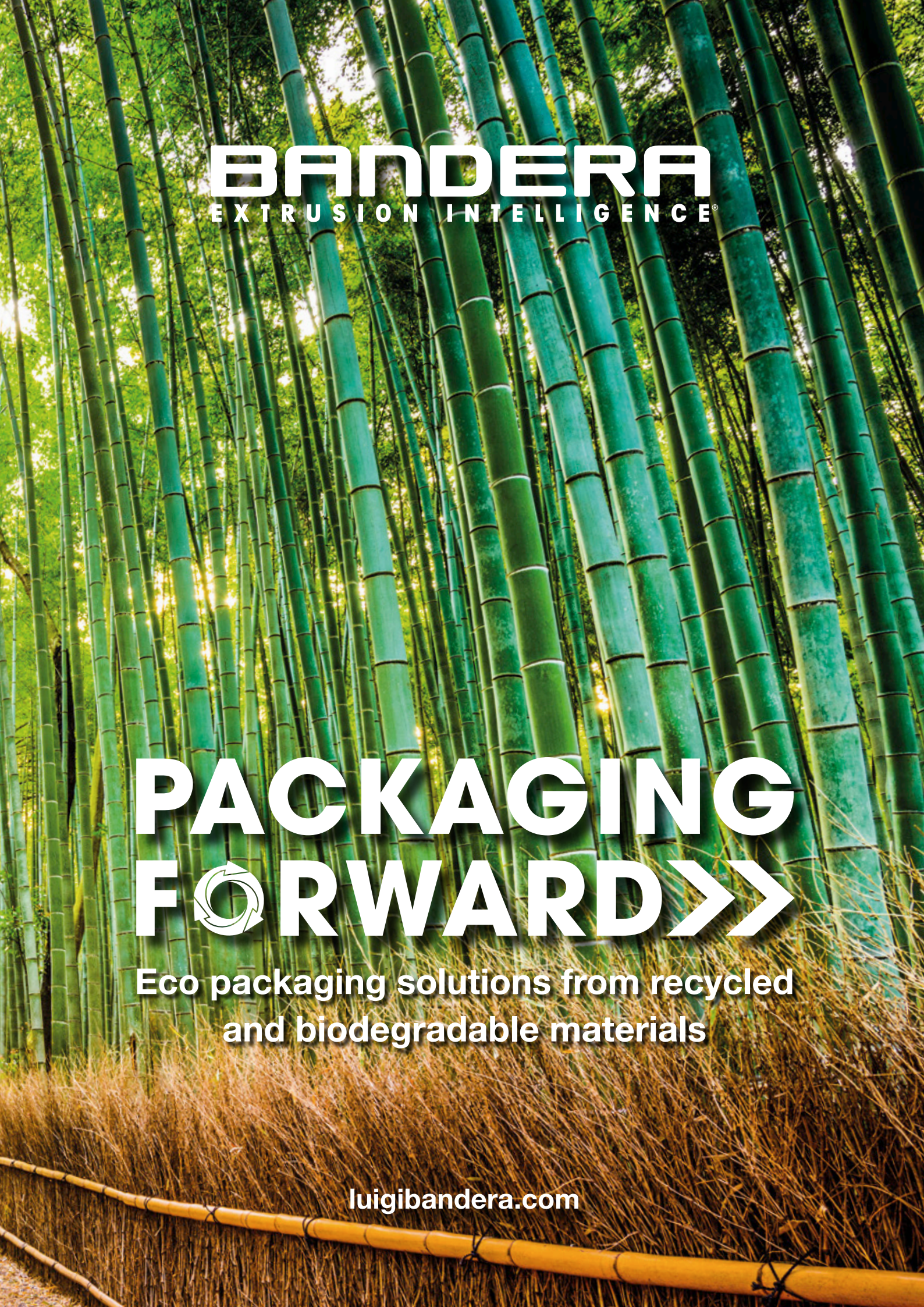
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AMI's Polymer Distribution in Europe 2018 study shows growth, M&A and new entrants to be key features of the market, writes the report's author Elena Mozzato of AMI Consulting

Consolidation drives European polymer distribution market

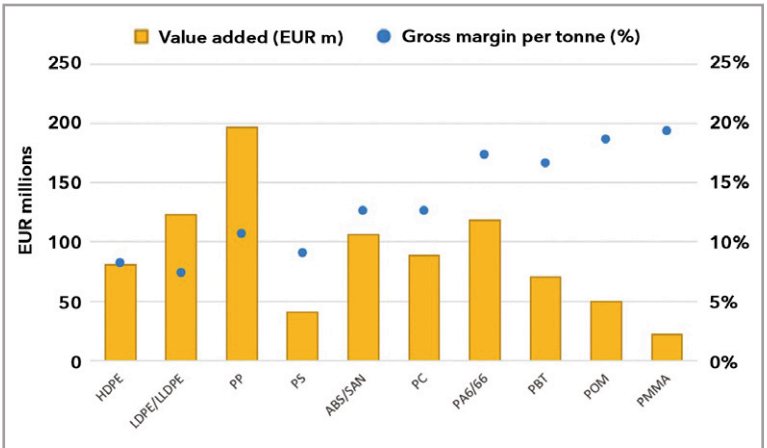
Polymer distribution plays an increasingly important role within the polymer industry supply chain providing opportunities for polymer producers to cut costs, improve efficiencies and deliver better service and support to the plastics processor. For converters, distributors enable them to purchase small lots of material and gain invaluable expertise and technical assistance in the journey from concept development to product delivery with its own customers. However, in an industry notorious for its slim margins and in a low growth economy, the successful distributor needs to be rigorous in understanding the cost-to-serve and the value gained from its customers in order to ensure its survival and growth.

Following challenging periods of resin price volatility and times of extreme resin shortages, distributors have managed to enhance profitability and margins by offering much needed reliable supplies of material, technical support and new services to customers. Innovative strategies and inventive customer dialogue have also been key elements in the strategy of successful companies in the industry.

The 2018 edition of AMI's Polymer Distribution in Europe report revises and updates the status and position of distributors across Europe. It builds on its earlier research to consider the newest trends influencing the industry, such as: the EU Strategy for Plastics in a Circular Economy; investments in bioplastics, recycled resins and 3D printing; a strong focus on plastics in pharma and medical sectors; digitalisation as a new competitive strategy; and Brexit's influence on the political and economic situation.

Continuing growth

Approximately 13% of polymer materials sold in Europe in 2018 were supplied through the distribution channel. This proportion is predicted to increase in the future as polymer suppliers move



Value added by distribution in the EU in 2017 (EUR million)
Source: AMI Consulting 2018

higher volumes through distribution to save costs and optimise sales networks. However, these benefits are likely to accrue to the larger, pan-European groups, presenting challenges to smaller distributors or groups.

In 2017, the volume of polymers distributed in Europe surpassed 4.0m tonnes, proving that this is a healthy business in which specialties are becoming increasingly important, as they add a competitive edge. Polymer distribution accounted for revenues of above €8.2bn, with polyethylene, polypropylene and polyamide being the largest contributors to an added value of nearly €950m.

The pattern of distribution sales and country ranking by sales volumes confirms Germany and Italy as the top two countries in Europe. These are now followed by the Benelux countries, which have seen distribution sales increasing substantially as local players who used to operate as traders have recently embraced the official distribution model. Spain ranks fourth, which corroborates the positive economic outlook the country has been recently enjoying.

Resinex remains the leading distributor in Europe, while other familiar names such as Biesterfeld and Ultrapolymers Group maintain a strong position in the market. The entrance into the official distribution market by historical traders such as Vinmar International, Bamberger Polymers and NCT Holland, represents the biggest disruption that the distribution sector has experienced over the last three years. Their presence is often seen as a threat by smaller local distributors who operate in markets where customer size varies enormously and where most clients buy small quantities. However, despite the lower prices these traders-turned-distributors offer and the disruption they may cause, they may often find it difficult to sell with success due to a lack of knowledge of local networks.

Despite the difficulties intrinsic to polymer distribution – including demanding customer service and tight margins – this is still a growing market, and so is attractive to many companies. The structural changes brought by recent M&A activities portray a lively business environment offering opportunities to those who are ready to grab them. During the last couple of years, industry news has been inundated by reports of strategic corporate moves. In the most remarkable deal of this year, LyondellBasell gave the industry much to talk about with its acquisition of compounder and distributor A. Schulman. While in September Univar announced the acquisition of Nexeo Solutions in a transaction worth $2bn.

Diverging directions

Consolidation and rationalisation activities have certainly posed a degree of uncertainty for smaller distributors who have seen their contracts with suppliers ended in favour of larger pan-European groups. This trend has been pushing some of the smaller players in the opposite direction and, now free from the impediments of exclusivity and binding contracts, they are moving towards more fluid distribution agreements. Overall, the big

Polymer Distribution in Europe 2018

Polymer Distribution in Europe 2018 is a new detailed market report from AMI Consulting published in September 2018. The report identifies the trends and dynamics characterising the distribution industry, while profiling the leading suppliers and polymer distributors in the region as well as their impact on industry dynamics.

Over the seven editions, this study has evolved into the most comprehensive analysis of polymer distribution currently available on the market and represents an essential guide for industry players as they optimise business activities and plan future investments. For further information please contact Elena Mozzato, **elena.mozzato@ami.international**, tel: +44 (0)117 924 9442.

In addition to its consultancy work, AMI organises annual conferences including Polymer Sourcing & Distribution 2019, which will be held in Barcelona, Spain on 13-15 May 2019 and is specifically created for companies involved at every stage of the European polymer supply chain. For more information on the event please contact Maud Holbrook, **maud.holbrook@ami.international**, +44 (0)117 314 8111.

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distributors are getting bigger, and the smaller ones are surviving by focusing on niche activities and the provision of unrivalled technical knowledge and customer support.

Over the next five years, polymer distribution sales are expected to continue growing above polymer demand as distributors take advantage of promising opportunities. On the one hand, the impending new polymer production capacity coming from the US, Middle East and Asia is forecast to be partly absorbed by existing distributors. On the other hand, the trend of traders embracing the official distribution model will become increasingly important as official agreements have proved beneficial, particularly in times of material shortage.

PHOTO: MANCHESTER PLASTICS

Engineering plastics

Engineering plastics are expected to continue driving the demand growth, with producers consistently investing in research and development activities to offer innovative products for new applications. Environmental sustainability and compliance with regulations will continue to be key elements in their R&D programmes and will stimulate manufacturers to expand and refine their product portfolio to gain competitive advantage.

Distribution markets of Central and Eastern Europe and Poland will continue experiencing the strongest growth as networks in this region are still growing and there is a greater opportunity to export to markets further east. Western Europe is forecast to grow at a slower pace as rationalisation activities have stabilised and suppliers are monitoring the outcomes of consolidation strategies.

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Building a future

Extruded film and sheet are crucial to construction projects – from huge sports stadiums to insulated windows. ***Lou Reade*** *reports*

Extruded products for construction range from home build projects to enormous capital projects – and none are more visible than enormous sports stadiums.

Polycarbonate sheet has been widely used for enormous stadium projects, including the recent renovation of the Luzhniki Olympic Stadium in Moscow – which hosted the World Cup final earlier this year.

During reconstruction, it received new grandstand roofing with multi-wall sheets made of **Covestro**'s Makrolon polycarbonate. The idea was no coincidence: even the old roofing was made of the material, says Covestro. Even after years of use, the panels showed only barely visible scratches and slight loss of colour. When the stadium was renovated, this positive experience led to the decision to use the same material, said Covestro. (Since the project's completion, Covestro has announced plans to sell off its worldwide polycarbonate sheet business – and has already sold its US arm of the business to Plaskolite.)

Around 36,000 square meters are covered with 25mm-thick, white multi-wall sheets. Around 30 trucks were needed to transport the panels – with a width of 1.20m and length of 9.8m – to Moscow. The X-structure of the sheet ensures high stability in all kinds of weather and withstands even high snow loads of up to one tonne per sq m. Thanks to new additives and a special UV coating, the polycarbonate sheets are also protected from weathering for 25 years.

Cost savings of 40-45% are another advantage in comparison to a glass roof construction. Polycarbonate sheets have a lower weight, making it easier to transport and process with much less effort, said Covestro – adding that substructures, often made of metal or aluminum, can also be designed in a more sophisticated way.

Saving steel

Specialist film suppliers are also finding use for their materials in gigantic sports venues: **3M Dyneon** says that its ETFE fluoroplastic has saved around 1,500 tonnes of steel in the construction of Estadio Cuauhtémoc – the home ground of Mexican first division football club FC Puebla.

Its façade consists of 124 vertical segments, each about 40m high. A total of 5,952 ETFE film sections in three shades were welded together for the segments. The ETFE films require no plasticisers – which would evaporate over time and could promote algae or fungal growth. ETFE films are

Main image: 3M Dyneon says its ETFE fluoroplastic saved around 1,500 tonnes of steel in the construction of Estadio Cuauhtémoc in Mexico

Above: Covestro is selling off all its polycarbonate sheet assets – such as those used in the Luzhniki Olympic Stadium in Russia

smooth enough to ensure that rain showers are sufficient to clean the façade. They are also resistant to other chemicals, so can withstand environmental influences such as exhaust emissions for decades, says 3M. Nowofol of Germany extruded the 200 micron films.

The weight per unit area of ETFE is around 95% lower than that of glass. As a result, only 1,000 tonnes of steel were needed to support the façade – compared with 2,500 that would have been needed for a glass version.

Insulating windows

At the *Polymers in Building Insulation* conference in Cologne, Germany earlier this year, Miguel Angel Rodriguez-Perez, of the Cellular Materials Laboratory (CellMat) at the **University of Valladolid** in Spain, told delegates of the emergence of materials with nano-scale cells.

He said that foamed materials have gradually moved from being 'microcellular' (with cell sizes of the order of 10 microns or less) to 'nanocellular' (with cell sizes below 300nm). These latest structures are far more effective insulators, he said – as the cells are similar to the mean free path of gas molecules.

"It allows the possibility of producing thermal insulating materials with conductivities below 10 mW/mK – three times smaller than that of EPS or XPS," he said.

He said that one weak link in building insulation was glass – which is the main cause of heat loss from buildings as it has conductivities of around 1,000 mW/mK. Silica aerogels might be used to replace glass – at least in translucent windows – but are very expensive and have inferior mechanical properties, he said.

For this reason, he proposed that a nanocellular PMMA material might work better, as it was cheaper, more hydrophobic and had better mechanical performance. Such a material could be made using gas dissolution foaming technology, he said, to create cell sizes below 50nm.

CellMat has created and tested such materials, which have cell sizes of around 14nm – and are transparent.

"These are promising materials for use in semi-transparent windows with improved thermal insulation," said Rodriguez-Perez.

He added that the current work was a 'proof of concept', and that further work was needed – specifically in reducing relative density, optimising processing conditions and characterising properties such as thermal conductivity in more detail.

The conference was organised by **AMI**. The next ***Polymers in Building Insulation conference*** is held on 9-10 April 2019 in Dusseldorf, Germany.

Solar honeycomb

Solar energy is becoming an increasing part of the energy mix – and solar panels are often incorporated directly into the structure of a building as a way of generating power for it.

EconCore says that its thermoplastic honeycomb sandwich panel technology – which is based on thermoforming – has been used in a number of new applications recently, including a new design of solar panel. The panel, from Armageddon Energy, is one-third of the weight of a standard glass equivalent solar panel, due mainly to the design being based on EconCore's ThermHex technology.

"The potential of a lightweight, durable solar panel is huge and this development opens up new markets and application perspectives, including those beyond photovoltaics," said Tomasz Czarnecki, COO of EconCore.

The substrate is Zytel polyamide from **DuPont** that is produced continuously and can be in-line

Right: Armageddon Energy has made a lightweight solar panel using EconCore's ThermHex technology

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Right: Heliatek's HeliaSol films have been used in the 'Solar Graffiti' project in Mexico

laminated with skin layers – made from DuPont's Vizilon thermoplastic composite – to deliver a cost-effective sandwich product uniquely suited to high volume production.

The development won a JEC Innovation Award in the USA last year.

Mexican graffiti

Sticking with solar energy, French energy group Engie recently launched an international advertising campaign, 'Engie Harmony', whose first project is 'Solar Graffiti' – an installation on a sports field near Mexico City that combines the graffiti with solar films from **Heliatek**.

'Solar Graffiti' is a project in which the Gomez Farias sports ground is being revived with 'green' lighting. With the energy stored during the day, the sports field can be illuminated in the evening.

A total of 111 HeliaSol films were installed – both on the wall elements and above, in wave forms. HeliaSol is Heliatek's ready-to-use solar product solution that can be applied to flat and curved surfaces and is flexible and lightweight (1 kg/m²).

"HeliaSol organic solar films are a perfect fit for this urban installation," said Thibaud Le Séguillon, CEO of Heliatek. "Together, we bring decentralised, decarbonised power generation to city centres."

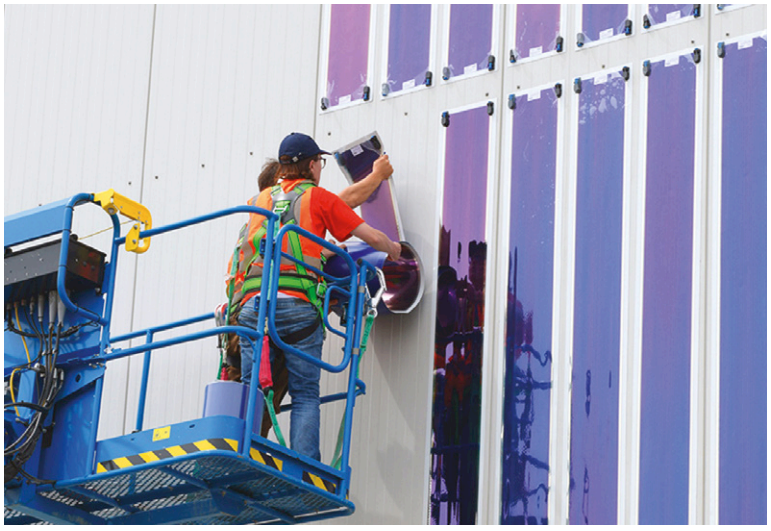
Engie owns an 8% stake in Heliatek, which has two production facilities in Germany.

Below: Heliatek's organic photovoltaic films have been installed on the façade of a warehouse of Duisburger Hafen

At the same time, around 185m² of Heliatek's organic photovoltaic films have been installed on the façade of a warehouse of Duisburger Hafen – which owns and manages the port of Duisburg.

The trial installation has 192 HeliaSol film panels – each 3m long – making it the largest facade installation to date with organic photovoltaics (OPV), says Heliatek.

HeliaSol is a thin, flexible solar film produced in a roll-to-roll process in Germany. Equipped with a self-adhesive backing, it can be applied directly to many surfaces without further assembly, and without affecting the structure underneath. With the project in Duisburg, the solar films were glued directly onto the metal facade of the warehouse. Ventilation or cooling is not necessary as the films do not lose power or efficiency at high temperatures.



The solar films generate about as much energy as a five-person household would consume annually, says Heliatek. Due to the efficient use of materials and manufacturing process, the solar films produce 80 times more energy over their lifecycle than is needed to make them.

Alexander Garbar, project manager for corporate development at Duisburger Hafen, said: "Heliatek's photovoltaic solution is fascinating, and we are pleased to have brought a German manufacturer on board. We are curious what the outcomes will be in the coming months."

Cooler sheet

German sheet extruder **VPW Nink** has started applying metallic colours to its range of corrugated PVC products – while using 50% recycled material in their construction. As well as being in demand for design reasons, the metallic colours also help to reflect light.

"About two years ago we had an idea to give our coloured standard PVC sheets – called Salux WS-Premium – a more attractive and modern design," said Anja Schendzielorz, head of R&D at VPW Nink.

The team developed the second generation of Salux WS-Premium with a shiny metallic protection layer, which looks like a real aluminium surface.

Metallic particles increase the reflection of infrared radiation, which results in a lower surface temperature (around 15°C cooler) of the PVC

Rail bridge blown into place

PHOTOS: BENJAMIN KROSOMER

Engineers from the **Technical University of Vienna** in Austria have built a bridge using a plastic air cushion to inflate it to its correct shape.

The structure begins as a flat sheet of concrete that has incisions cut into it. Then, an enormous plastic air cushion – positioned underneath the concrete – is inflated. Over the course of five hours, the flat sheet is transformed into a concrete dome. The ends of the dome are then cut away, to form a bridge.

"It took around five hours to inflate the cushion and create an elongated concrete dome with an internal height of 7.60m," said Benjamin Kromoser of the Institute of Structural Engineering at TU Wien.

The first major tests were carried out three years ago at a TU Wien test site, but now the method has been used in this real-life project by the Austrian Federal Railways.

The bridge is used as a wildlife crossing over a section of track on the Koralm railway in southern Austria.

› **www.tuwien.ac.at**

sheet. The lower surface temperature helped to reduce the risk of material deformation of the sheets on hot summer days.

The company recently expanded the range with metallic colours in red, green and copper versions. At the same time, the lower side of the sheet contain a high amount of recycled plastic – up to 25% regranulate from post-consumer waste, plus 25% regrind from the company's own operations.

Flame-retardant PET

DuPont Teijin Films says that its Melinex FR2XX halogen-free, flame-retardant PET film could help designers in a range of industries provide improved safety at low cost.

The film combines the inherent properties of polyester with the VTM-0 flame rating certified by UL's UL 94 flame classification testing.

"Traditional PET polyester films are well-known for their performance and reliability characteristics, and this new film type has combined those properties with a VTM-0 certification," said Scott Gordon, business development manager at DuPont Teijin Films.

Some polymer films offer inherent flame retardance, but at a price up to 30 times that of PET films. Most PET films, while physically durable, typically have flame classification ratings at the VTM-2 level.

Melinex FR220 is the first clear halogen-free VTM-0 PET polyester film in a planned series, said the company.

Typical applications include laminate structures for construction and transportation, battery labels, insulating materials for wire and cable, electronic office products, lighting and flexible printed circuitry.

DuPont Teijin Films is in the process of being acquired by Indorama Ventures.

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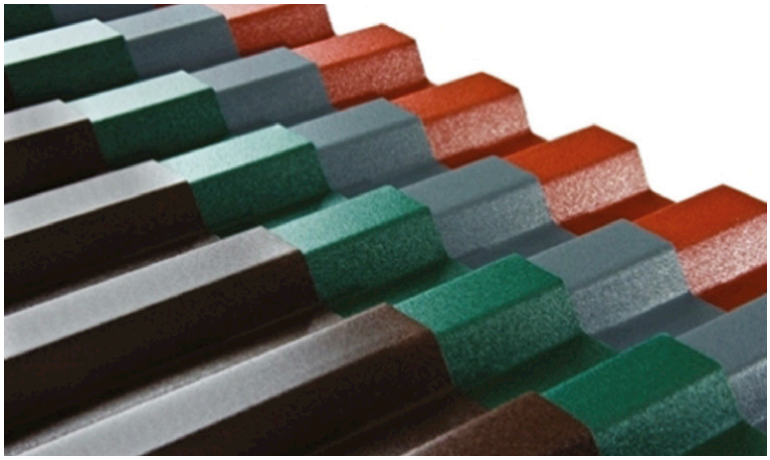

Below: Using metallic colours to its Salux range of corrugated PVC products helped VPW Nink to reduce surface temperature

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See more **online**

Thin wall packaging – especially in thermoforming – is seeing a number of technical developments, as well as a considerable amount of market consolidation. ***Lou Reade*** *reports*

Cutting weight to boost performance

While the production of thermoformed packaging continues to get faster, there are always methods to improve on it – be it through mechanical or material methods.

Dutch thermoforming packaging specialist Unipak, for instance, has used anti-block additives from **Van Meeuwen Chemicals** to help make its products easier to process.

"When we applied the anti-block for the first time, we killed two birds with one stone," said Nico Scheepers, plant manager at Unipak in Steenbergen. "Blockages were greatly reduced, and transparency was better. There was also a third advantage: the additive costs less than the masterbatch we used before."

Instead of adding a masterbatch to the granules, the additive is instead 'misted' onto the surface of the sheet.

In production, the first step is to extrude the granules at temperatures of up to 270°C. Afterwards, the product is in a state between solid and liquid. Next it is cooled on wheels, and the anti-block is added using a nebuliser – just before it goes into the forming machine. Because the final product will hold foods, the additive must be safe for food contact. It took some experimenting to arrive at the exact right composition, said the company.

"At first, the anti-block was applied too thickly so that boxes stuck together and stickers detached from them," said Scheepers. "But now we know exactly what proportions we need."

Using the liquid additive – rather a granular masterbatch – for the PP or PET also saves around 30% in costs, he added.

Star performer

At this year's NPE exhibition, **Battenfeld-Cincinnati USA** demonstrated how its StarExtruder series has been optimised for processing PET. It recently received a letter of non-objection from the FDA for its use in making food-grade thermoforming sheet, for the production of thin-walled packaging. ›

Main image: Unipak has used anti-block additives from Van Meeuwen, making its products easier to process

Processing PET can be a challenge, as the presence of water during processing can lead to degradation reactions – and effective degassing is needed.

The processing unit has three sections: a single screw zone for plastification of the material; a planetary roller section for degassing under high vacuum; and an optimally dimensioned discharge zone. The planetary roller zone gives efficient degassing of the melt. The melt is then rolled out in very thin layers and an extremely large surface is created. Both effects counteract the degradation of the materials and contribute to optimal product quality, says the company.

The machine is available in sizes of 90, 120 and 150mm, which are suited to small and medium output ranges from 600-1,200 kg/h (1,300 to 2,600 lb/hr).

End-line accessories

Amut-Comi has added two accessories to its ACF series of thermoforming machines, to cover the end-line automation steps.

The accessories are: a new set of stacking systems; and, handling and packaging solutions. Each was designed and manufactured in-house.

The stacking systems include: Up Stacker, with a maximum speed of 60 cycles/min (depending on material, type of mould and stacking sequence); Down Stacker – IVB model – for fast change of stacking tools, and having a maximum speed of 45 cycles/min; and ERX model pick and place robots, with a top speed of 38 cycles/min in two versions – one with two axes and one with three axes. ERX robots perform A-B or A-B-C stacking with or without item rotation. Visual control system of the product quality can be also provided, says the company.

At the same time, the company's Easy Lift automation system is used for handling of thermoformed products. Its conveyor belt receives the items from the thermoforming machine at an adjustable height and down to a level of 800mm. This facilitates the working conditions of the operator and the integration of automatic packaging systems, says the company.

Below: Amut-Comi has added accessories – including stacking systems – to its ACF thermoforming machines

Next generation

Reifenhäuser Cast Sheet Coating has introduced a new generation of PET thermoforming sheet lines – using its Reitruder twin-screw extruders and a modernised version of its Mirex-MT-V range of mechatronic polishing stacks.

Depending on customer requirements, different coextrusion feedblocks are available. Customers have often expressed a desire for simple (quasi 'plug and play') production – so feedblocks are now available both for fixed layer geometries and for Reicofeed 2.1 systems that can be configured during operation.

Also, completely modernised dies are available. For example, the producer can choose between internal deckling for maximum flexibility in the film width, or a lip gap that can be configured during operation for fast thickness changes, as well as between manual or automatic operation with thermal expansion bolts.

Updates to the polishing stack have also been made. Depending on the system capacity, it has three or four polishing rolls, while there is an option for an axis crossing for the first roll – for making thin films with large widths.

Super barrier

Tekni-Films, part of Tekni-Plex, has developed a super barrier-coated (SBC) thermoformable film for pharmaceutical blister pack.

Tekni-Films says that its SBC 240 can be used as an alternative to 4- and 6-mil PCTFE and cold formed foil in thermoformable blister applications. The triplex structure is ideal for applications such as pharmaceuticals, nutraceuticals, probiotics and related products.

As well as having high clarity, the material does not require stiffening ribs – which improves on PCTFE's ability to lie flat – or the oversized blister wells created by cold forming. This means that pharmaceutical companies can use a smaller blister card to contain the same number of tablets or capsules, or increase the count on a same-sized card. The end result is material cost savings throughout the packaging process, as well as improved production efficiencies.

SBC 240 offers high moisture and oxygen barrier properties to protect susceptible products

Left: Tekni-Films has developed a super barrier-coated (SBC) thermoformable film for pharmaceutical blister packs

from degradation. It also has a wider processing window than PCTFE – as much as 20F – which helps it meet specific production speed preferences.

It is created by applying a 'next generation' high-barrier variant of polyvinylidene chloride (PVdC) coating to a film structure made from layers of polyethylene (PE). Multiple layers can be applied to create different coating thickness weights. As coating weight increases, so do barrier attributes.

This grade is the latest example of Tekni-Film's SBC thermoformable film capabilities. It also offers 120-, 150-, 180- and 210-gram coating thicknesses, as well as other custom solutions.

Faerch in buying mood

Danish food tray supplier **Faerch Plast** is looking to expand operations by acquiring French packaging specialist CGL Pack from PSB Industries.

CGL manufactures bespoke packaging solutions for the food service industry, healthcare and consumer products. The acquisition includes the activities of two French manufacturing sites in Annecy and Lorient.

"We are impressed by CGL's extensive product portfolio and innovative design capabilities," said Lars Gade Hansen, CEO of Faerch Plast. "We have a long history in the French market, and believe the combination with CGL would be an excellent opportunity for both parties."

Faerch Plast was itself taken over late last year, by private equity fund Advent International.

More recently, Faerch has acquired 4PET Group, based in the Netherlands. 4PET manufactures PET sheet for thermoforming and also carries out recycling. At its recycling plant in Duiven, Netherlands, 4PET recently started a new tray-to-tray PET recycling line, which it claims is unique for creating a PET tray closed loop.

Faerch Plast CEO Lars Gade Hansen said: "The

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recycling system offered by 4PET Group is an innovative, industrial-scale break-through in our transition towards a sustainable circular economy. It enables us to take responsibility for the post-consumer phase of our trays."

Graham builds up

Graham Partners, a US-based private equity firm, has made its third thermoforming investment in the shape of Nuconic Packaging. This comes less than a year after the acquisitions of Tray-Pak and EasyPak.

Located in Vernon, California, Nuconic supplies thermoformed PET packaging to the food market, and its products are complementary to those of EasyPak and Tray-Pak, said Graham. Nuconic brings "a unique approach to product and tool design, which will allow the combined platform to deliver an expanded offering to the market", said the company.

Adam Piatkowski, managing principal at Graham Partners, said: "Nuconic has experienced strong growth driven by a strategic market focus and strong customer relationships, and we have identified significant synergies due to the expanded geographic coverage and capabilities of the combined platform."

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Left: Graham Partners has made its third thermoforming investment by acquiring Nuconic Packaging

Design for Sustainability 2018

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Food waste is a huge global problem. Packaging can minimise the losses; active and intelligent packaging technology can provide even greater protection. Jennifer Markarian reports

Packaging gets active

Packaging plays a vital role in protecting the quality of food and pharmaceuticals from spoilage or degradation caused by oxygen, moisture and bacteria. Passive barrier layers limit oxygen and water vapour transmission into the package while vacuum packaging or modification of the gas in the package by purging with nitrogen or carbon dioxide provide additional protection.

However, active packaging—that is packaging that uses additives that either absorb unwanted molecules or release helpful ones—is also finding growing use. Combining active packaging with intelligent packaging – incorporating sensors that can indicate freshness, for example – takes the technology one step further.

Packaging supplier **Sonoco** says packaging can play a significant role in alleviating the challenge of food waste. At the end of last year, the company established a partnership with Clemson University in South Carolina, US, called Sonoco FRESH that aims to further efforts in this direction. "The vision is to create a hub where academia will collaborate with the public and private sectors to develop solutions to reduce food waste. As much as one-third of the global food supply is wasted, and we believe that packaging technology advancements can reduce this number significantly. The Sonoco Foundation has committed to a gift over five years to establish this hub as well as $1m in research funding to support proprietary Sonoco projects at the university," the company said at the time.

The push for more recyclable packaging is driving growth in mono-material, multilayer film structures that use active packaging solutions, such as oxygen absorbers, to maintain or improve properties, according to Roland Schultz, Director of Global Marketing at **Albis**. Ilias Ali, Research Engineer at packaging supplier **Printpack** agrees, saying that using a combination of passive and active barriers in a mono-material (typically either PP or PET) for improved recyclability is increasing.

Meanwhile, the **AIMPLAS** plastics technology centre in Spain is developing customised solutions for ethylene scavengers. These are intended to eliminate ethylene from the package environment, so slowing down the ripening processes and the deterioration of vegetable products or flowers and extending their shelf life. ›

Main image: One third of food produced for human consumption globally goes to waste. Packaging can cut waste; active and intelligent technologies provide further protection

PHOTO: ALBIS

Right: Monomaterial films containing active components can substitute more complex and difficult-to-recycle multi-material packaging, according to Albis

Antimicrobial options

One of the challenges for food packagers is to extend the shelf-life of 'natural' foods with no or reduced preservatives. Antimicrobials in the packaging can help extend shelf life, but they must also be approved for use in food-contact plastics. "There has been significant research in this area [antimicrobials], but very few technologies have been successfully commercialised for primary food packaging due to effectiveness, cost and regulatory restrictions," according to a spokesperson from Sonoco. However, the company continues to evaluate both additives and coatings that provide antimicrobial properties to a variety of packaging formats, particularly for fresh foods.

An additive from Thailand-based **Life Materials Technologies** (LIFE DJ/AM-00-1A) combines an inorganic antimicrobial with a molecular sieve, with the two working synergistically in plastic packaging to help delay spoilage of foods. LIFE DJ/AM-00-1A is said to comply with biocide regulations in the US and EU and is approved for use in food contact plastics globally, according to Tom Ellefsen, CEO of Life Materials Technologies (the company's products are distributed in European markets by **Velox**).

Natural additives obtained from fruit waste or other agro-industrial waste are being investigated as active-packaging additives. The aim is to take advantage of the fact they are edible and therefore give rise to no concerns in food packaging, says Vanessa Gutiérrez, Researcher in the Compounding Department at Aimplas. Potential additives include highly antioxidant substances that can be obtained from olive and vine industry byproducts, she says. Extracts with antifungal and antibacterial properties have also been obtained from garlic and onion production and from orange peel. These have been shown to have a proven ability to improve the shelf life of foods such as strawberries and fresh cheese.

Challenges of using natural active substances compounded into plastics to obtain an active package include controlling the release rate of the active substance, the thermolability (sensitivity to heat) that most natural antimicrobials display, and the effect these additives can have on organoleptic properties, says Gutiérrez. "There are somewhat thermal stable extracts, such as oregano, thyme, cinnamon, clove (up to 250°C), which can be used in polyolefins and some polyesters, that offer high activity after multiple processing steps, for example compounding, extrusion and thermoforming. But there are several other extracts such as garlic and rosemary with a decomposing temperature close to 150°C, which make them suitable for only low temperature processing polymers, such as LDPE, EVA or TPS."

Encapsulating additives

AIMPLAS researchers have developed additive incorporation methods using encapsulation and employing suitable carriers. It says encapsulation offers release control, thermal and shear protection, and the additional advantage of offering the ability to handle a powdered agent instead of a liquid.

One experiment used an additive based on encapsulated garlic extract, which is an antibacterial and antioxidant agent, in a PLA matrix. A container for fresh salad using the additive showed a significant difference from the control container with no active additive after four days at room temperature (Figure 1). In another experiment, 1% of a garlic extract was incorporated in a polyethylene film used to package strawberries. The additive showed the ability to significantly protect the fruit from mould growth (Figure 2).

"Depending on the final product to be packed, organoleptics could affect the customer's perception. However, even when using garlic extract (the strongest smell), the product taste of strawberries was not affected," says Gutiérrez. She adds that researchers continue to work on different encapsulation processes to minimise the organoleptic issues while keeping the activity of the extracts.

Organoleptics can affect the consumer's impression of freshness in vacuum-packaged meat products and a new technology from **Bemis** is intended to provide a solution to this problem. "When combined with low oxygen transmission

Figure 1: Packaged salad samples after four days at room temperature. Both containers are made from PLA; the pack on the left contains an active encapsulated garlic extract additive

PHOTO: AIMPLAS

Plastics Regulations

Pittsburgh / 2018

Responding to new and future regulatory developments that will impact the plastics supply chain

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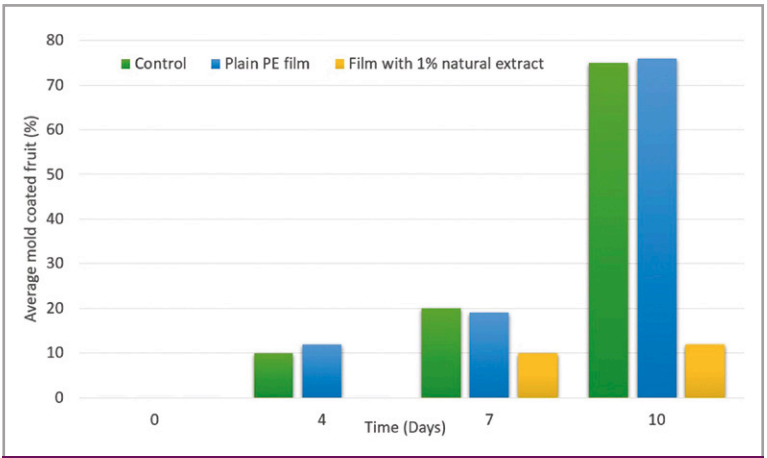

Figure 2: Researchers at AIMPLAS have shown that PE films containing an encapsulated active garlic extract can reduce mould growth in packaged strawberries
Source: AIMPLAS

rate (OTR) films, vacuum packaging extends meat shelf-life by reducing headspace oxygen, which in turn decreases the growth rates of spoilage bacteria and minimises the organoleptic effects of lipid oxidation. However, an unintended consequence of using low OTR packaging is the development of confinement odour," says Ankush Gokhale, PhD, Senior Research Scientist at Bemis Central R&D in Wisconsin.

Although this odour quickly dissipates once a package is opened, its detection by the consumer has a negative impact on acceptability, Gokhale says. Confinement odour is a particularly vexing problem for the poultry industry. "Because use of traditional low OTR vacuum packaging leads to confinement odour, processors often choose to use packaging that supports freer gas exchange at the expense of more rapid bacteria growth. Bemis's new technology addresses this shortcoming by adding a new form of intervention that helps to maintain the quality standards set by meat processors."

Odour suppression

The Bemis technology uses potassium sorbate—an FDA-compliant food ingredient—compounded into the food-contact layer of the packaging inside an oxygen barrier (Figure 3). "The novel combination of potassium sorbate modification and low OTR packaging films results in slower bacteria growth rates as well as suppression of confinement odour," says Gokhale. "The new Bemis technology will help poultry processors estimate 'sell-by' dates with added precision and better corroborate consumers' freshness expectations. Additionally, shelf life extension techniques like this help producers reduce food waste."

Gokhale says that the company worked with the Food Research Institute (FRI) at the University of Wisconsin-Madison over the past couple of years to test the validity of the packaging concept. "The researchers at the FRI documented the concept's microbiological and organoleptic benefits on confinement odour, meat texture and colour under different packaging conditions," he says.

Bemis is also working on a packaging film containing a melt-compounded odour absorber used for organoleptic enhancement of some ground meat products. Another development from the company is the Bemis Freshcase vacuum packaging for fresh red meat, which uses *in-situ* generation of nitric oxide to maintain the red colour associated with fresh meat. In this packaging technology, sodium nitrite particles are melt compounded into the food-contact layer of the films, where it is reduced to nitric oxide by enzymatic activity on the meat surface. The nitric oxide stabilises the bright red colour associated with meat packaged in a high oxygen environment, while enabling the microbiological shelf-life advantages of low OTR packaging, the company claims.

Active pharma

In pharmaceutical packaging, there is an increasing need for active packaging solutions, according to **Aptar CSP Technologies** (CSP Technologies was acquired by the Aptar Group in August). The company specialises in development and production of active packaging for food, pharmaceutical, nutraceutical and other applications using its Activ-Polymer compounds. These incorporate additives to absorb or adsorb moisture, gases and odours, or to release gases (such as aromas or antimicrobials). For example, the company's Activ-Film materials are used in stick packs, pouches, and sachets. Its Activ-Seal gas-scavenging technology is designed to be built into induction-sealed screw caps. And its Vital containers are one-piece, flip-top desiccated vials and bottles used for probiotics.

In September, CSP Technologies announced a collaboration with PCI Pharma Services, a contract manufacturer and contract packaging company for the pharmaceutical industry, to further develop its Activ-Blister solutions. This technology is intended to control the headspace inside individual blister cavities in blister packaging. "The collaboration will expedite time to market for drugs and probiotics, among other oral solid dose applications. PCI Pharma will have the capability to produce clinical trial and stability study product with Activ-Blister solutions that might otherwise have significantly longer lead time for customers," says Craig

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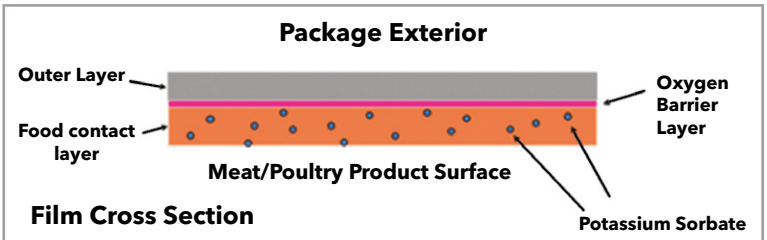

New Bemis packaging technology for vacuum packaged meat

- **Use low OTR film to slow the growth of aerobic bacteria and limit lipid oxidation**
- **Add potassium sorbate to the food contact layer of low OTR film to achieve slower bacterial growth and suppression of confinement odour**

Figure 3: Schematic showing the construction of the latest active odour control solution for vacuum packed meat from Bemis
Source: Bemis

Voellmicke, Vice-President of Business Development for Aptar CSP Technologies.

This active packaging solution provides an alternative to high barrier films and foils where it is necessary to achieve extended shelf life. The Activ-Blister products scavenge moisture and/or target gases from three sources: in the blister at the time of packaging; from ingress over time; and from moisture/gas released from the packaged drug tablet or capsule.

"High barrier films, while an effective barrier to environmental conditions, can also trap moisture in the package at time of production, as well as retain moisture and gases that are released over time from the oral dose," explains Voellmicke. He says that purging (often with nitrogen) is used to lower the amount of oxygen in a standard blister package made with high barrier foils, but the process can be difficult to manage and especially difficult to achieve lower levels of oxygen.

In addition, purging is typically limited to high barrier foil packages, because standard barrier thermoformed packages typically allow too much oxygen ingress to make purging worthwhile. "By contrast, Activ-Blister can achieve very low oxygen levels [without purging] by scavenging the gas present at time zero and—when used in combination with thermoformed materials with oxygen barrier properties—any additional oxygen ingress over time," he says.

Engineering solutions

Although active packaging is often concerned with minimising moisture and/or a gas in a package, Aptar CSP has also engineered materials to create and maintain elevated moisture levels while releasing desired gases. "Novel drug formulations and drug/device combinations can benefit from these package headspace conditions to enhance shelf life," says Voellmicke. "In these applications, drying of the drug/dosage form can be detrimental to stability.".

Voellmicke expects to see continued demand for customised active packaging solutions, such as child resistant or senior friendly (CRSF) designs, as well as the addition of intelligent technology to active packaging and a gradual convergence of active and intelligent packaging.

Another partnership was announced last month between **Pylote**, which has an active packaging antimicrobial technology, and packaging company Amcor. The two companies launched a stick pack laminate for liquid pharmaceuticals that offers protection from microbial contamination without using preservatives in the liquid. Pylote's technology uses mineral microspheres incorporated into the high barrier packaging material.

Indicator advances

Among available intelligent packaging options is the use of indicators incorporated into the package or in a label to indicate the state of a modified atmosphere or the quality of the packaged goods. Sensors can indicate when a package has been opened or can identify changes in pH or temperature in order to give the end-user a measure of "freshness" or quality, which could also help address the significant problem of food waste by supplementing or replacing use-by dates. The problem is being tackled from various angles by academia and industry to find sensors that will work hand-in-hand with active and passive barrier packaging.

For example, UK-based **Insignia Technologies**' FreshTag and After Opening Freshness Timer are time and temperature sensitive labels based on colour-changing pigments extruded in polymer

PHOTO: APTAR CSP TECHNOLOGIES

Right: Activ-Blister from Aptar CSP Technologies is an alternative to high barrier films for sensitive drugs

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PHOTO: AMCOR

Right: Amcor worked with antimicrobial technology firm Pylote to develop this stick pack for preservative-free liquid pharmaceuticals

films. The colour change rate depends on carbon dioxide diffusion through the barrier film in the label or as a response to changing temperature. The company claims to be able to develop pigments that can respond instantly or over a pre-calibrated time period, allowing it to customise sensing performance. Typical applications include indication of food freshness, packaging opening times, cold chain integrity, and or tampering/damage to the packaging.

Modified atmosphere packaging (MAP) presents specific challenges for the food industry. Lola Gómez, Researcher in the Functional Printing and Coatings Department at AIMPLAS, explains that MAP replaces air inside the headspace with an inert gas (nitrogen or carbon dioxide) that increases shelf-life by displacing the oxygen that reacts with food to cause rancidity or that promotes the growth of aerobic microorganisms that decompose food. "In a typical MAP food package line, the quality and proper performance of MAP is measured with expensive analytical equipment. Furthermore, during food package transportation and delivery, small impacts can cause a loss of the hermeticity without any way to check it. There is a clear need for a cheap and reliable oxygen indicator able to provide a simple response related to quality and safety," she says.

AIMPLAS is currently conducting research to develop an oxygen indicator that is suitable for food contact, easy to handle, adjustable regarding oxygen concentration, economical and that provides an irreversible response to the presence of oxygen, Gómez says. The researchers are looking at indicators based on redox sensors that comprise a UV-absorbing semiconductor, a redox-indicator, a sacrificial electron donor and an encapsulating polymer as an ink that can be coated on different substrates.

Below: Insignia Technologies' intelligent film-based indicator labels can be customised to specific performance requirements

PHOTO: INSIGNIA TECHNOLOGIES

The sensors become colour-less when activated by UV light and are re-oxidised to their original colour when exposed to oxygen, showing that oxygen has entered the package. The researchers are optimising the sensor to be sensitive to low concentrations of oxygen. To date, the indicators have been tested in a number of coatings. Temperature-resistance of the reagants will have to be checked if the indicators are to be incorporated in a polymer using a compounding process, says Gómez.

Natural sensors

Researchers at **Clemson University** (in South Carolina in the US) have, in the past, focused largely on antimicrobial food packaging. However, they have recently been investigating spoilage sensors based on autoinducers, which are the signaling molecules sent by cells as they start to break down. The method, called quorum sensing, takes what the micororganisms do naturally and combines that with the ability to sense the onset of a food spoilage then builds both functions in to a sensor, according to Kay Cooksey, Cryovac Endowed Chair of the Clemson Food, Nutrition and Packaging Sciences department at Clemson.

Cooksey's goal is to develop a sensor that detects food spoilage when it begins, which she says will be an improvement over current detectors, such as those for meat packaging, that change colour based on volatile ammonia or sulphur that occur when meat spoil. "By the time the colour change occurs, the human nose can just as easily detect the aroma of the volatiles," she says. "Results from the proposed research will serve as a foundation for biosensors and ultimately intelligent packaging to effectively monitor changes in food and, in turn, improve food quality and safety."

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Delegates at the recent Smart Packaging conference – organised by AMI, and held in Hamburg, Germany in October – were presented with a range of technologies, ranging from roll-to-roll manufacturing of smart packaging labels to paper-based electrodes and active packaging simulations. Here, we round up some of the highlights.

ADDITIVES

Fraunhofer uses simulation to develop new packaging with oxygen scavengers

Astrid Pant, research associate at **Fraunhofer Institute for Process Engineering and Packaging** (IVV) in Germany, explained how the organisation had used simulation to develop active packaging – with a focus on oxygen scavengers.

The research involved designing, producing and characterising active materials – including gallic acid (as an oxygen scavenger), sucrose (as a humidity regulator) and AITC. These were incorporated into a bio-based polymer matrix, for use in packaging for certain types of food. In one example, the team produced an oxygen-scavenging tray, and an anti-microbial lid film, for ready-to-eat sandwiches.

At the same time, the active functions of the package were modelled for attributes such as gas exchange. This was validated by experimental data – and a close fit was found. The method helped in the development of a new oxygen scavenger, in which its kinetics were modelled and compared with those of an existing product.

The simulation can be used to pre-select potential applications very quickly – with only the most promising being taken forward, she said.

The team is part of a larger project to produce paper/plastic packaging that regulates internal humidity.

› **www.ivv.fraunhofer.de**

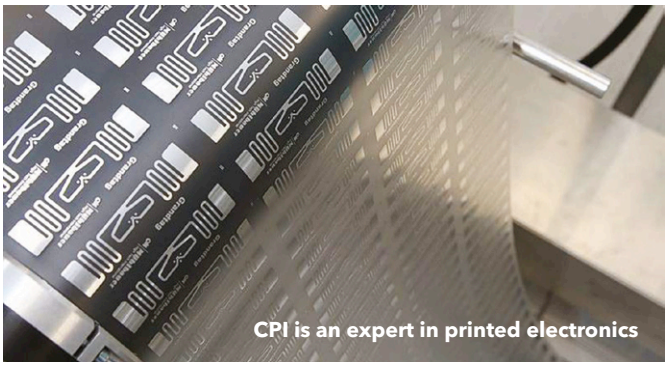
PRINTING

Roll-to-roll for medical safety

The Centre for Process Innovation (CPI) in the UK explained how smart packaging will be vital in assuring the safety of medicines in future.

Tim Marsden, project manager at CPI, told delegates about the Remedies project, which will incorporate printed electronics – made in a roll-to-roll process – into the pharmaceuticals supply chain.

The concept could be used in areas such as cold chain delivery – in order to ensure that vaccines, for instance, are held at the correct temperature for their entire journey.



CPI is an expert in printed electronics

Information within the label would be accessed via an app – for which a demonstration version has already been developed.

Some of the challenges to developing a commercial system include: balancing cost and price; scaling the production process; transferring data securely; and public perception of the technology.

Marsden says that, while the presentation focused on the pharmaceutical supply chain, other collaborations are already underway to develop concepts – with companies including GSK, Henkel and Crown.

› **www.uk-cpi.com**

ELECTRONICS

Sensors help to stay cool

Temperature indicators incorporated into packaging can help to ensure that the cold chain is not compromised, said Marta Klanjsek Gunde of the National Institute of Chemistry in Slovenia.

'Conventional' sensors would not work here – and any used would need to be recycled along with the final packaging.

She said a solution like thermochromic printing ink or labels might be affordable enough for routine use by 2025.

› **www.ki.si/en**

Next year's Smart Packaging event will return to Hamburg. It will run on 10 and 11 September 2019. For more details about attending, booking exhibition space or suggesting a topic for a paper, contact Emily Renshaw (Emily.renshaw@ami.international) on +44 (0) 117 3145 8111, or visit the conference website.

Forming the right response to regulatory questions

PHOTO: SHUTTERSTOCK

Regulation of plastics is intensifying around the world, making it essential for companies to keep on top of compliance. We preview AMI's Plastics Regulations, Pittsburgh 2018 conference, the first to take place in the US

Main image: Hear from experts who know the plastics rulebook

AMI's Plastics Regulations conference provides expert analysis and guidance on a range of international legislative and regulatory issues that will impact on polymer producers, compounders, processors and end users doing business in the US and beyond. The two-day conference takes place in Pittsburgh, PA on December 11-12.

Legal and regulatory experts will cover new and impending regulations in areas such as TSCA, product stewardship, biomaterials, single-use plastics, plastics waste and the Circular Economy. Key stakeholders from Europe will also address issues from across the Atlantic affecting the plastics supply chain in the US.

Food contact legislation is another evolving subject that has significant implications for the suppliers of polymers, additives, compounds and masterbatch, as well as the producers of food packaging and food processing equipment. Legal experts at the conference will review existing and planned regulations in this area and provide advice on how to meet them.

Here we preview the conference, highlighting expert speakers from government agencies, compliance departments and specialist law firms.

US regulatory scene

The opening session of Plastics Regulations, Pittsburgh 2018 takes a closer look at the current regulatory landscape and some of the challenges likely to affect those in the plastics industry. **Ed Brzytwa**, the Director for International Trade at the **American Chemistry Council (ACC)** in the US, starts proceedings with a look at how global trade conflicts are impacting on the US economy and the business of chemistry. This is followed by a talk from **Christopher Thelen**, Regulatory Specialist at **M. Holland Company** in the US, who discusses a modest new approach to regulatory compliance.

Product stewardship

The second session features **Bernard Henn**, Supplier Development Manager at **Verisk 3E** in the US, who investigates modernising product stewardship in the plastics industry. The second talk in the session, focusing on biomaterials supplier liability issues with regards to FDA regulation and managing risk, is given by **Frederick A. Stearns**, Partner at law firm **Keller and Heckman** in the US. **Beth Trenor**, Advanced Regulatory Specialist at **Milliken & Company** in the US, then presents from

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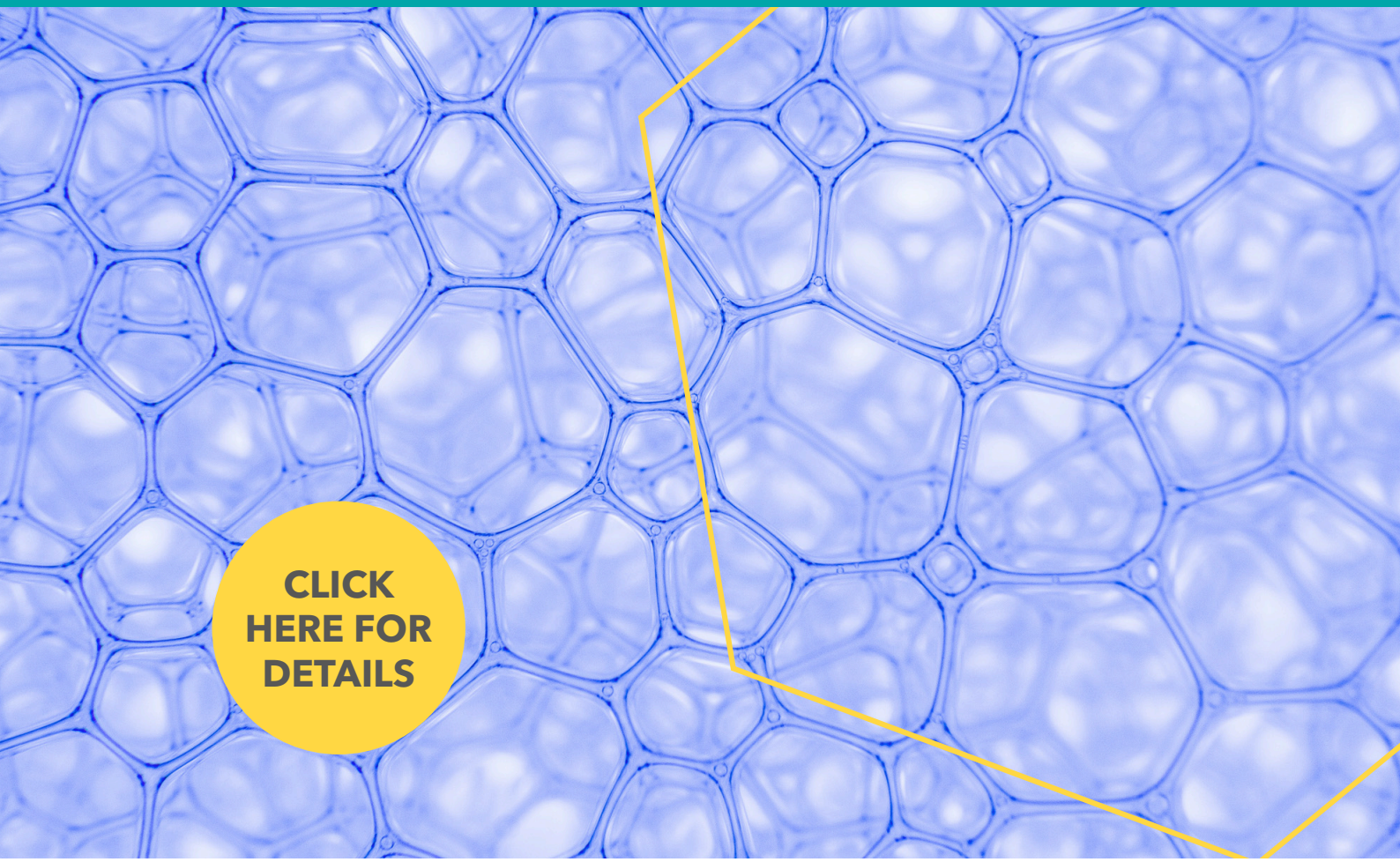
28 - 29 November 2018
Marriott Hotel, Hamburg, Germany



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the additive supplier perspective and how Milliken is thriving through innovation in a challenging regulatory environment.

After lunch, the session is continued by **Dee Wilson**, Senior EHS Specialist at **UL Product Supply Chain Intelligence** in the US, who covers antimicrobial protections as a solution in the move towards reducing single-use plastic waste – the talk focuses on the regulatory challenges and requirements for pesticides.

Europe and beyond

The final session of day one opens with a paper about the recent proposed amendments to the EU Waste Framework Directive from **Dr Anna Gergely**, Director, EHS Regulatory at **Steptoe & Johnson** in Belgium. This is followed by a look at the Circular Economy and plastics by **Roberto Crespi**, Senior Associate Lawyer at **Fieldfisher** in Belgium.

After a networking and refreshment break, **Alfred Voskian** and **Jytte Syska**, Partners at **Syska Voskian Consulting** in the US and Denmark, then discuss EU REACH and CLP (Classification, Labelling and Packaging) regulations affecting the plastics industry. The final talk of the day is given by **Michael Fischer**, Vice President, Codes and Regulatory Compliance at **Kellen** in the US, who focuses on the impacts and solutions relating to construction regulations in China, for US producers of foam plastic-core insulated metal panels.

To round off the day's proceedings, a networking drinks reception is being held in the exhibition room, where delegates and speakers debate the conference so far and attendees have the opportunity to network with industry peers.

Speakers at the conference include (from top): Christopher Thelen from M. Holland, Bernard Henn from Verisk 3E, Frederick A. Stearns from Keller and Heckman, Grant B. Kenion from Henkel, Jim Mo from CIRS Group and Ruud Overbeek from Decernis

Food contact

Day two of the Plastics Regulations conference is opened by **Dr Mitchell Cheeseman**, Managing Director at **Steptoe & Johnson** in the US, who looks at building a global strategy for innovative food contact products.

This is followed by a close look at the US FDA Food Contact Notification Program presented by **Dr Jessica Cooper**, Review Chemist at the Center for Food Safety and Applied Nutrition, Office of Food Additive Safety in the Division of Food Contact Notifications at the **US Food and Drug Administration (FDA)**.

After the morning refreshments, **Jim Mo**, Business Development at **CIRS Group** in the US, showcases a road map to Food Contact Materials and Articles regulations in China.

And finally, **Naeem Mady**, Vice President, Regulatory Market Access, Health, Environmental & Regulatory Services (HERS) at **Intertek** in the US, presents a paper on migration protocol in support of global food contact notifications and compliance.

Packaging applications

The final session of the conference begins with a look at emerging issues and insights related to food and beverage packaging delivered by **Dr Ruud Overbeek**, Chief, Business Development & Strategy at **Decernis** in the US.

Dr Dave Brassington, Vice President Regulatory Affairs at **Addivant** in the UK, explores non-intentionally added substances and developing new plastic additives in the era of the parts-per-trillion detection limit.

Closing the conference is **Dr Grant B. Kenion**, Scientific Fellow at **Henkel Corporation** in the US, who makes a comparison between direct contact, different food contact layers, and conditions of use analytical extractive studies versus diffusion modelling predictions.

About Plastics Regulations Pittsburgh 2018

Plastics Regulations 2018 takes place on 11-12 December at Pittsburgh Mariott City Center, Pittsburgh, PA, in the United States. In addition to the formal conference sessions detailed above, attendees will benefit from the chance to discuss and network during informal refreshment breaks and at the drinks reception in the evening of day one.

Whatever your role in the polymer supply chain, AMI's Plastics Regulations conference will give you vital information on how to ensure your company is compliant with current and future chemicals legislation. Don't get caught out by new legislative developments. Attend Plastics Regulations, Pittsburgh 2018 to discover the most effective ways to protect your business and ensure compliance. Book your place today!

For further information about attending the event, please contact the Coordinator, Shannon Slaff: **shannon.slaff@ami.international** Tel: +1 610 478 0800. More information at the **conference website**.

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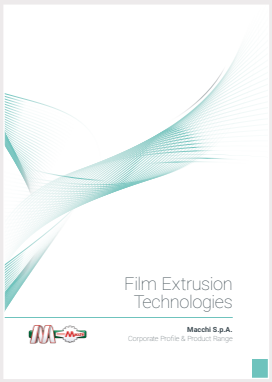
MACCHI: FILM EXTRUSION



This 28-page brochure from Macchi covers the company's wide range of film extrusion technologies including coextrusion lines, wide webs, die heads, take offs, winders, trim recovery and control systems.

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COLINES: BARRIER FILMS

This new brochure from Colines focuses on extrusion lines for the production of barrier films for vacuum and modified atmosphere packaging to preserve foodstuffs and medical products.

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W&H: VAREX II FILM SYSTEMS

Varex II is Windmöller & Hölscher's latest universal system for high output blown film production. This publication details the critical Varex II system features that ensure production of the highest quality films with minimal scrap and highest plant efficiency.

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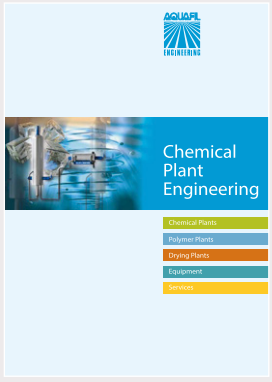
AQUAFIL: PLANT ENGINEERING



This 12-page brochure from Aquafil Engineering details its comprehensive range of chemical plant engineering capabilities, which include polyamide polymerisation, polyester condensation and polymer drying installations.

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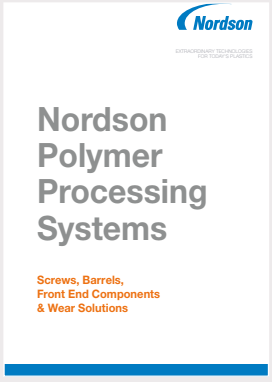
NORDSON: SCREWS & BARRELS



In this Nordson Polymer Processing Systems brochure, find out about Xaloy bimetallic extrusion screws and barrels, designed to meet process requirements, help optimisation, combat wear, boost output, and improve and maintain quality.

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If you would like your brochure to be included on this page, please contact Claire Bishop claire.bishop@ami.international. Tel: +44 (0)1732 682948

Learn more about AMI's upcoming conferences

Click on the relevant brochure cover or link to download a PDF of the full conference programme

STRETCH & SHRINK FILM USA 2018

The 13th Stretch & Shrink Film USA returns to Ft Lauderdale, FL, USA, on November 13-14. The event provides a comprehensive overview of the latest material, technology, and market trends.

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MULTILAYER FLEXIBLE PACKAGING 2018

The 11th edition of AMI's international Multilayer Flexible Packaging conference will take place on 19-21 November in Vienna, Austria. The three-day programme will cover the latest technical developments and market trends in this dynamic sector.

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POLYMERS IN FLOORING 2018

The third edition of AMI's international Polymers in Flooring conference is taking place on 4-5 December 2018 in Berlin, Germany. The event provides a unique forum bringing the polymer flooring industry together to debate technical and market trends.

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PLASTICS REGULATIONS US 2018

Plastics Regulations on 11-12 December 2018 provides expert analysis and guidance on a range of international legislative and regulatory issues that will impact on polymer producers, compounders, processors and end users doing business in the US and beyond.

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THIN WALL PACKAGING 2018

The 13th edition of AMI's popular Thin Wall Packaging event will take place on 11-13 December 2018 in Cologne, Germany. This key event gathers together leading brand owners, retailers, packaging manufacturers, researchers and suppliers to the plastics packaging industry.

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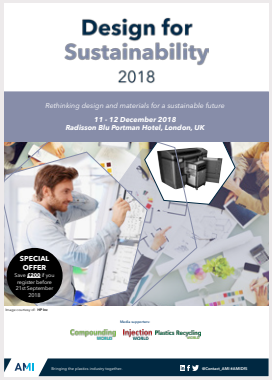
DESIGN FOR SUSTAINABILITY 2018



A new conference, Design for Sustainability on 11-12 December 2018 in London, UK, discusses how innovations in polymer materials and processes can help designers meet the sustainability challenge in packaging, automotive, electronics and other markets.

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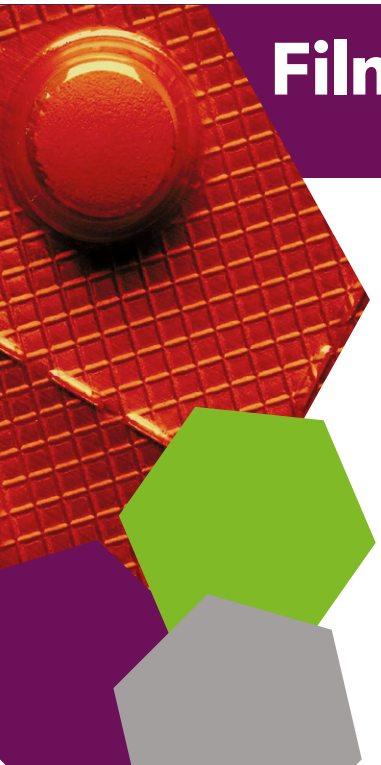
To see our full line-up of more than 50 plastics industry events over the next 12 months, please visit www.ami.international/events

Diaxon

Head office:	Komotini, Greece
CEO:	Georgios Zagliverinos
Founded:	2000
Ownership:	Public (subsidiary of Hellenic Petroleum – which trades on the Athens and London stock exchanges)
Turnover (2017):	Around €16m
Profile:	Diaxon, established in 2000, is a subsidiary of Hellenic Petroleum – which produces both propylene and polypropylene at its complex in Thessaloniki. The latter is delivered to Diaxon for conversion into bioriented polypropylene (BOPP) film. The company says that its output largely meets the needs of the domestic market – which is growing rapidly – for applications including food and cigarette packaging.
Product lines:	The company supplies a wide range of its 'HP Film' BOPP film to a variety of markets. Some of its products include: a coextruded film (CO-3-X) that is heat sealable on both sides, and is aimed at a variety of food packaging applications; metallised films (such as ME-3-X), for food packaging; matte films, including one grade (Malt-X) that has a low sealing temperature on one side; a non heat-sealable film for use as wrap-around bottle labels; plain films for either tape or food applications; a pearlised film for food applications; and, coextruded products with low and steady coefficient of friction.
Factory location:	The company's production facility, at the Komotini Industrial Park in north-eastern Greece, runs two Brueckner production lines, making a range of BOPP film. Diaxon is updating its operations with the installation of several supply chain software packages from Greycon, which should become operational in early 2019, it says.

To be considered for 'Extruder of the Month', contact the editor on lou@filmandsheet.com



Film and Sheet Extrusion FORTHCOMING FEATURES

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

December 2018
Additives for polyolefins
Extruder developments
Multi-layer packaging
Mineral fillers for films

January/February 2019
Developments in bioplastics
Materials testing/quality control
Polyolefins for film/sheet
Medical materials/applications

Editorial submissions should be sent to Lou Reade: lou@filmandsheet.com

For information on advertising in these issues, please contact:
Claire Bishop: claire.bishop@ami.international Tel: +44 (0)1732 682948
Levent Tounjer: levent.tounjer@ami.international Tel: +44 (0)117 314 8183

Keep informed: read our latest editions

AMI publishes five process-specific FREE plastics industry magazines. Simply click on the cover below to read each magazine. Or download the issue in the relevant Apple or Android app

Film and Sheet
October 2018
The October edition of Film and Sheet Extrusion examines multi-layer technologies for barrier films. It also reviews the latest moves in film stabilisation and extruder machinery and explores developments in carbon black.

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Film and Sheet
September 2018
The September 2018 edition of Film and Sheet Extrusion magazine takes a detailed look at the latest developments in the plasticiser sector. It also reviews innovations in biaxial films, laboratory extruders and downstream equipment.

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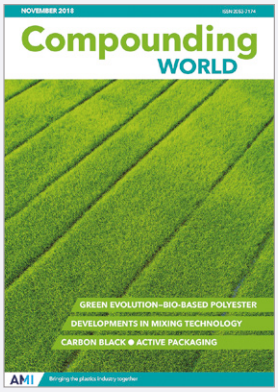

Compounding World
November 2018
The November edition of Compounding World contains features on bio-based polyesters, mixing technologies, carbon black and additives for active packaging. Plus there is a review of Fakuma and key findings from AMI's European polymer distribution report.

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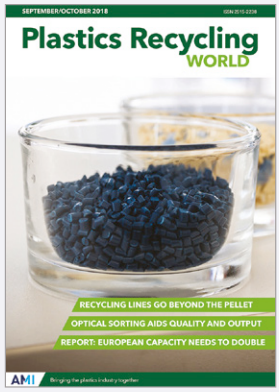

Plastics Recycling World
September/October 2018
The September/October edition of Plastics Recycling World looks at the equipment on offer for direct recycling to sheet. Plus, exclusive analysis of Europe's recycling capacity needs and a review of the latest optical sorting technologies.

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Pipe and Profile
October 2018
The October edition of Pipe and Profile Extrusion magazine has features taking an in-depth look at pipe inspection, oriented PVC, advances in materials handling and new methods for in situ pipe production. The edition also previews AMI's Conductive Plastics conference.

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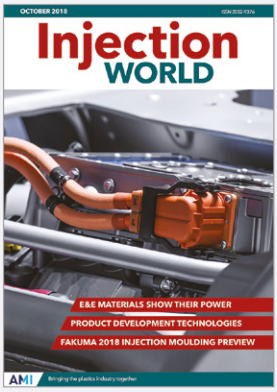

Injection World
October 2018
The October edition of Injection World magazine reviews developments in plastics for electrical and electronic applications. It also takes a look at product development technologies and the latest materials handling innovations.

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Compounding WORLD
Film and Sheet EXTRUSION
Pipe and Profile EXTRUSION
Injection WORLD
Plastics Recycling WORLD

GLOBAL EXHIBITION GUIDE

2018	**26-29 November**	All4Pack, Paris, France	www.all4pack.com
	5-7 December	Plastic Japan, Chiba, Japan	www.plas.jp/en
	5-8 December	Plast Eurasia, Istanbul, Turkey	www.plasteurasia.com/en
2019	**5-8 January**	ArabPlast, Dubai	https://arabplast.info
	12-15 March	Pro-Pack Africa, Johannesburg, South Africa	www.propakafrica.co.za
	12-16 March	Koplas, Seoul, South Korea	www.koplas.com
	19-21 March	EU Coatings Show, Nuremberg, Germany	www.european-coatings-show.com
	25-29 March	Plástico Brasil, São Paulo, Brazil	www.plasticobrasil.com.br
	8-12 April	Feiplastic, Sao Paulo, Brazil	www.feiplastic.com.br
	8-9 May	Compounding World Expo, Cleveland, USA	www.compoundingworldexpo.com
	8-9 May	Extrusion Expo, Cleveland, USA	www.extrusion-expo.com
	8-9 May	Plastics Recycling World Expo, Cleveland, US	www.plasticsrecyclingworldexpo.com
	21-24 May	Chinaplas, Guangzhou, China	www.chinaplasonline.com
	21-24 May	Moulding Expo, Stuttgart, Germany	www.moulding-expo.com
	18-21 September	T-Plas/Tiprex, Bangkok, Thailand	www.tplas.com
	16-23 October	K2019, Dusseldorf, Germany	www.k-online.com
2020	**16-20 January**	Plastivision India, Mumbai, India	www.plastivision.org
	21-23 January	Swiss Plastics, Lucerne, Switzerland	www.swissplastics-expo.ch
	7-13 May	Interpack, Dusseldorf, Germany	www.interpack.com

AMI CONFERENCES

13-14 November 2018	Stretch & Shrink Film US, Coral Springs, Florida
11-13 December 2018	Thin Wall Packaging, Cologne, Germany
5-7 February 2019	Polyethylene Films, Coral Springs, Florida, USA
27-28 February 2019	Breathable Films, Berlin, Germany
14-15 March 2019	Speciality Packaging Films Asia, Bangkok, Thailand
2-3 April 2019	Plastic Pouches, Vienna, Austria
8-10 April 2019	Stretch & Shrink Film, Barcelona, Spain
25-26 June 2019	Multilayer Flexible Packaging, Chicago, USA
17-18 September 2019	Housewrap, Coral Springs, USA

For information on all these events and other conferences on film, sheet, pipe and packaging applications, see

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