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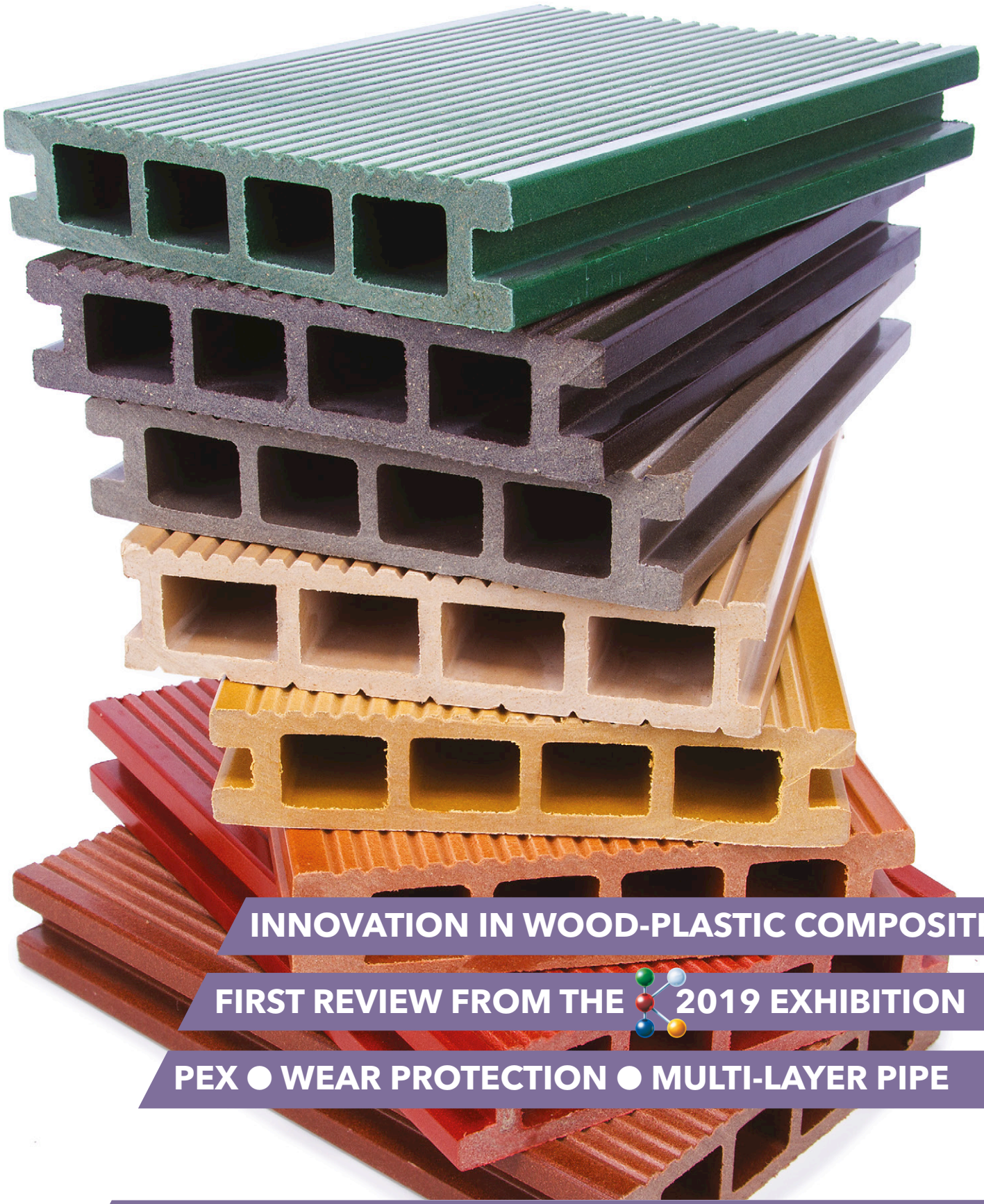

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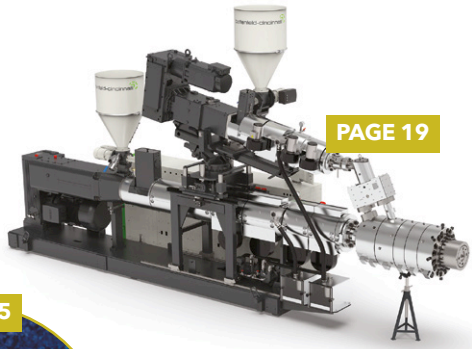

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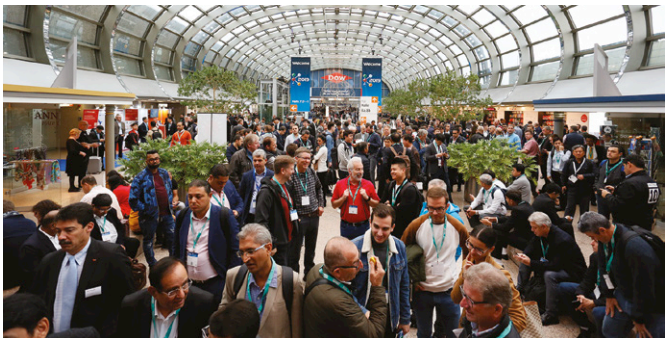
Pipe and Profile EXTRUSION

Sustainability was the key theme at K2019

Sustainability was a key theme at this year's K2019, with many exhibitors showcasing technologies such as chemical recycling, single-material flexible packaging and bioplastics.

Ulrich Reifenhäuser, chairman of the exhibitor advisory board at K2019, said: "Never before has the industry addressed an issue so unanimously – and worked on solutions so consistently – as is the case now, in the fields of environmental compatibility, saving resources and avoiding waste."

The proportion of foreign visitors at this year's show exceeded 73%, compared with nearly 71% in 2013. Asia accounted for around 40,000 visitors – with large contingents from India, China and Japan. Almost 20,000 visitors came from North and South America – a 7% increase compared to 2016. There was a marked increase in the number of visitors from Brazil.



This year's show attracted nearly 225,000 visitors, which was slightly less than in 2016

At the same time, exhibitor numbers rose from 3,285 (in 2016) to 3,330 at the latest edition.

Messe Dusseldorf, which organised the exhibition, said there were 224,116 visitors this year – about 2.6% lower than the official figure from 2016 (which was put at 230,000). This compares with 218,000 visitors at K2013.

The next K show will be on 19-26 October 2022.

› **www.k-online.de**

Pipelife and Perstorp honoured at 'PVC innovation' awards

This year's Inovyn awards, which recognise innovation in PVC, saw winners in fields as diverse as recyclable pipe and fibre-reinforced window frames.

"We had nearly 100 projects this time – about 25% more than the last awards three years ago," said Filipe Constant, Inovyn's chief commercial officer.

In the sustainability category, Perstorp took the silver award for its Pevalen Pro non-phthalate plasticiser, which is based on partly renewable raw materials.

The bronze award went to Pipelife Netherlands for developing three lives for PVC piping for Dutch gas network operator Alliander. Recycled twice, it has a total lifespan of 150 years.

In design, the silver award went to TechPlas Extrusions for its Techboard planks, which are 30% lighter, stronger and more durable than wood due to internal hexagonal reinforcements. It also has an end-of-life recycling scheme. Benvic and Geplast took the bronze award for their honeycomb profiles. The Fokus rolling shutter box has better thermal and acoustic insulation, and is made with different grades of PVC – including rigid, plasticised, virgin and recycled.

In the process category, Solvay took silver with its Alve-One, a chemical blowing agent for use in flooring and artificial leather in the car industry. It can also be used for cables, cladding, foam sheets, pipes and packaging.

› **www.inovynawards.com**

Italian machine sales slow

Amaplast, the Italian plastics machinery association, released mid-year figures showing that the country's trade in plastics machinery continued to decline in H1, albeit at a slower rate in Q2 than Q1.

Overall, the association said imports were 17% down on H1 2018, while exports were 5% down. There was a very slight improvement in the balance of trade.

The decline is mainly the result of a slump in trade with Germany, which is Italy's largest biggest import and export partner for plastics machinery. Imports and exports fell by 26% and 33% respectively, Amaplast said.

Most other European national markets were also down for Italian exporters, as was South America. North America was slightly up but by far the strongest markets were in the Far East and Middle East, with China showing a 39% increase, Thailand 55% and Indonesia more than doubling albeit from a low base.

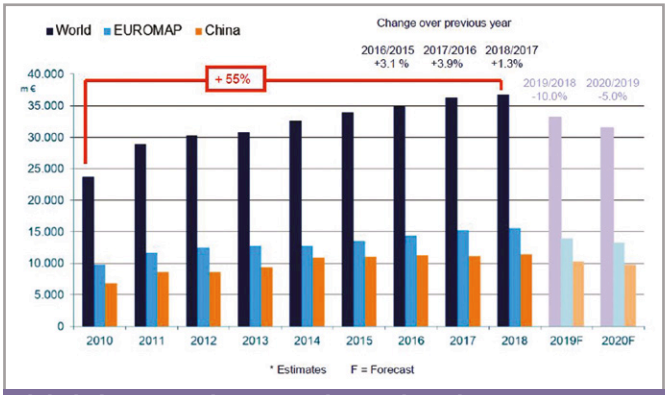
Looking ahead, the association predicts ongoing weakness in the plastics market. "Overall, there is concern for the tendency towards a postponement or reduction in orders by customers," the association said.

› **www.amaplast.org**

Global machinery output to fall by 10% in 2019, says Euromap

Global production of plastics machinery grew by 1.3% in 2018 to reach a value of €36.8bn, according to data released at K2019 by the European plastics and rubber machinery association Euromap. European machinery makers enjoyed growth above the global rate, at 1.9%, taking the total for the region to €15.6bn. However, that was a poor performance by recent standards and producers are now preparing for much weaker demand.

"After 10 years of continuous growth and an increase in the Euromap production of 59% since 2010, 2019 will see the expected economic dip," said Luciano Anceschi, President of the association.



Global plastics machinery production by value, 2010-2020
Source: Euromap/VDMA

"Apart from a worldwide economic slowdown, it's above all the slump in the automobile sector as well as decreasing investments due to political uncertainties caused by the trade conflict between USA and China, Brexit and unpredictable national laws for the use of plastics that are clouding over business prospects."

Euromap is forecasting a 10% decline in global production this year to €33.1bn. The value of European plastics and rubber machinery production will also fall by 10% in 2019 to €14.0bn.

A further 5% contraction is forecast for 2020, with both global and European production down 5% to €31.5bn and €13.3 bn respectively.

The association believes EU demands to raise plastics recycling volumes to 10m tonnes by 2025—four times today's levels—and to ensure all plastics packaging is recyclable by 2030 will provide a boost for manufacturers of both recycling and processing machinery. "Circular Economy will thus become a growing business field and have positive impacts on machinery manufacturers who enable a functioning circular economy by applying their technologies," said Euromap Vice President Michael Baumeister.

› **www.euromap.org**

Trex breaks ground on new WPC manufacturing plant in Virginia

US-based Trex, a leading manufacturer of WPC decking and railing, has broken ground on a new manufacturing facility in Frederick County, Virginia.

The company is adding a new decking plant next to its existing production site to meet continued growth and projected product demand. The new facility is expected to create more than 150 jobs.

"This is an exciting time for us with all signs pointing to continued growth and escalating demand," said Jim Cline, president and CEO of Trex. "We've been planning this for some time and have been eager to break ground and welcome new talent."

The new Virginia capacity will begin to come online in early 2021, says the company. The company is planning to hire and train new employees in manufacturing, skilled trades and engineering positions.

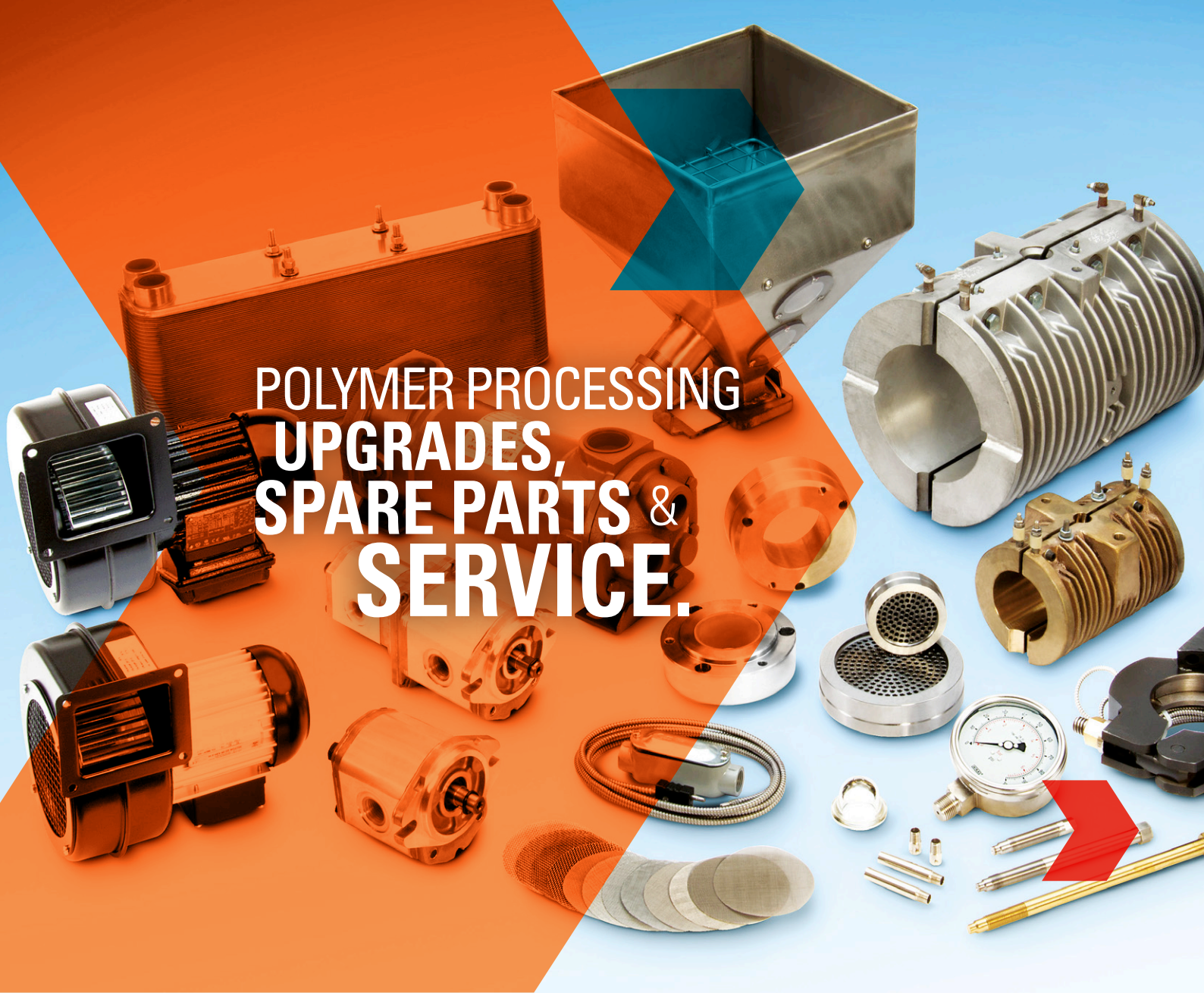
The new facility is part of a US$200 million capital investment programme that will allow Trex to increase production output for future projected growth. In addition to expanding capacity in Virginia, Trex is also installing extra capacity at its Nevada site that began coming online earlier this year. The new lines in Nevada are scheduled to come online in the second quarter of 2020.

■ Trex reported a 17% increase in sales for the third quarter of this year. Sales for the period rose to US$195 million.

Sales at Trex Residential Products rose 24% to US$183m. The commercial products division contributed US$12m to sales. Net profit for the period was US$42 million.

"We continued to experience robust demand for our residential decking products in the third quarter," said Cline. "Growth was led by the appeal of the Trex brand and the value proposition our products represent, strong demand for the new Enhance product line."

› **www.trex.com**



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Leading suppliers sign up for fast-growing plastics exhibitions

Leading suppliers from the fields of plastics recycling, compounding, extrusion and testing have booked stands at four focused exhibitions that will take place at Messe Essen in Germany on 3-4 June 2020.

The Plastics Recycling World Expo, Plastics Extrusion World Expo, Compounding World Expo and Polymer Testing World Expo will all be free to attend. They will feature five free conference theatres hosting business debates, technical presentations and training seminars. Last year's debut event in Essen attracted 4,024 visitors.

"We already have over 250 exhibitors signed up for next year's shows, which is 20% more than the final number at our launch event in Germany in 2018, and we still have seven months to go," said Rita Andrews, Head of Exhibitions at AMI, the organiser of the exhibition. "The vast majority of exhibitors at the first expos rebooked their stands, and many new names are signing up, having seen the size and quality of the audience at Essen last year."

The launch event in Essen, in 2018, was well attended

Companies that have already reserved stands at the event include leading suppliers of polymers and additives, such as BASF, Biesterfeld, Borealis, Cabot, Clariant, Evonik, ExxonMobil, Imerys, Omya, Solvay, Wacker and Westlake Global Compounds. The international line-up of exhibitors at Essen will also boast an international array of plastics recyclers and waste management companies such as K Kanellakis, Montello, Rodepa, Sogapol, Van Werven, Veolia and Vita Plastics.

Visitors to the Essen expos will also be able to find out about the latest developments from the suppliers of a wide range of extrusion, compounding and recycling equipment.

The new Polymer Testing World Expo will provide a focused meeting place for scientists, laboratory staff, researchers and R&D professionals who develop, test and analyse plastics materials and products. Relevant exhibitors that have already booked stands at Essen include Frontier Lab, Norner, Dynisco, Brabender, Collin Lab & Pilot Solutions, Fraunhofer, Konica Minolta, Labtech Engineering, Richard Hess MBV and ZBT.

"There is considerable crossover between the different sectors of the plastics industry that are covered by these four focused exhibitions, which will benefit exhibitors and visitors alike," said Andy Beevers, Events Director at AMI. "For example, 1,722 of the visitors to the last year's compounding and recycling shows in Essen said that they were involved in materials R&D and testing, which led to the addition of the Polymer Testing World Expo."

Stands at the exhibitions start at less than €3,000. For more information contact AMI's exhibition team at **exhibition_sales@ami.international**

Conference programme confirmed for *Plastic Pipes in Infrastructure*

Speakers from Molecor, Wavin and Georg Fischer have been confirmed for AMI's *Plastic Pipes in Infrastructure* conference, which takes place in Hamburg, Germany in April 2020.

The conference will discuss progress in manufacturing and materials (including recyclates), as well as innovations and developments in plastic pipe systems.

A number of end-user case studies – including one from an irrigation project in Spain – will highlight the industry in practice.

Plastic pipe systems are fast replacing more traditional materials in areas such as drinking water supply and distribution, gas distribution, underground drainage and sewerage, and district heating.

Plastic Pipes in Infrastructure also offers the opportunity to network with industry experts from across the supply chain. There is a networking reception at the end of the first day.

For more details, contact the conference organiser Nicola Charlesworth (**nicola.charlesworth@ami.international**) on +44 (0)117 314 8111. The latest programme is available **here**.

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North America: machine sales reduce in third quarter of 2019

The value of primary plastics machinery (injection moulding and extrusion) deliveries in North America fell slightly marginally in the third quarter of 2019, according to statistics from the Plastics Industry Association's Committee on Equipment Statistics (CES).

The early estimate of sales from reporting companies totalled nearly US$294 million. After an 8% increase in the second quarter, deliveries fell by 0.5% in the third quarter. However, while total delivery value decreased, extrusion machinery sales increased in the quarter: single- and twin-screw extruder sales rose by around 5% and 14%, respectively, comared to Q2, while those for injection moulding fell nearly 2%.

While it appears that deliveries flattened from the previous quarter, they were down nearly 16% from a year ago.

The delivery value of twin-screw extruders fell by almost 30% in that time, and single-screw extruders fell by more almost 6%. For comparison, injection moulding machinery sales value fell nearly 16% compared to the same period last year.

"The plastics industry is a mature industry and its growth will continue to track gross domestic product (GDP)," said Perc Pineda, chief economist at the association.

"The third quarter numbers moving sideways are in sync with weaker manufacturing activity in the economy this year. In Plastics Quarterly, our GDP growth forecast for the second and third quarters were 2.0% and 1.9%, respectively and that's what we got," he added.

The CES also conducts a quarterly survey of plastics machinery suppliers that asks about present market conditions and expectations for the future. In the coming quarter, 39% of respondents expect conditions to either improve or hold steady – lower than the 56% that felt similarly in the previous quarter.

For the next 12 months, 63% expect market conditions to be steady-to-better, up from 53% in the previous quarter's survey.

› **www.plasticsindustry.org**

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*Wood-plastic composites (WPCs) are finding use in a range of new applications – including, potentially, window frames. **Lou Reade** reports*

Wood effect: latest developments in WPCs

Wood-plastic composites (WPCs) are fully established on the market as a material for making decking and other outdoor products, but so far has had a limited effect on one of the most lucrative construction products: window frames.

However, at the recent Profiles conference in Cologne, Germany – organised by **AMI** – Daniel Friedrich, a researcher at **Compolytics** in Germany, told delegates about the potential of using WPC materials for window frames.

While the majority of WPCs are used for applications such as decking and fencing, Friedrich said that a few WPC window frames already exist – though there are pros and cons to their performance.

On the plus side, he said the materials had the potential to improve environmental performance and contribute towards a more sustainable use of natural resources. This comes from replacing up to 45% of the pure PVC in a window frame with wood flour, or similar wood-based filler.

WPC-filled PVC compares favourably against most traditional window profile materials, he said. Against PVC, he said it had higher stiffness, better sustainability (due to lower carbon emissions) and a higher 'energy storage'. This last point refers to the amount of energy – in the form of heat – that it transmits in use. The end result is that less heat is lost from the house to the outside.

The material also performs well against pure wood – having better resistance to fire, moisture and weather effects.

Compared with aluminium, it has lower thermal conductivity, better energy storage, lower cost and higher sustainability.

Critical parameters used in the building industry, such as U-value (which measures heat transfer) and the lambda-value (thermal conductivity) are superior with WPC materials, he said.

"PVC can be 'greened' with wood fibre," said Friedrich. "However, there is an optimum level of around 40% loading."

However, while WPC windows can improve energy efficiency, and wood fibres replace more expensive PVC resin, the windows are more expensive than traditional PVC windows because of the cost of processing them.

Main image: WPC window frames could offer advantages over those made of wood – and even PVC

Above: WPCs are commonly used in decking in place of traditional wood products

"At the moment, it's too expensive," he said. "Maybe that's one reason why WPC windows have not been successful."

Several companies have launched WPC-based window products, including Switzerland-based Fentech, with its Fibrex product. However, the product did not gain a significant share of the market, said Friedrich.

Other than trying to reduce the price of WPC window frames, more research is needed into improving surface appearance, flame retardancy and recyclability, said Friedrich.

"WPC products are coming to the end of their lives – and recycling them is a problem that is very close," he said. "Nothing will happen unless there is pressure. It's currently hard to know how recyclable it is compared to pure PVC."

Other conference delegates brought up potential problems of WPC-based window frames, such as weldability.

"There would be far more applications of WPCs if production costs were lower," he said. "We have had many ideas for WPC products – not just window frames – but many of them are not economical."

At the moment, he said that the economic advantage that WPC would bring – by saving on heating costs – are not outweighed by the higher price of using the material.

Processing aids

Despite the many advantages of WPCs – such as moisture resistance and easy installation – they can be difficult to process. At the Profiles USA conference earlier this year, Ali Goger, research engineer at **Ingenia Polymers** of Canada, told delegates how the company had assessed the effect of different elements in the formulation on product quality.

Processing aids are needed to overcome issues such as edge tearing, weak mechanical properties, narrow processing windows and poor flow properties.

He presented details of tests that the company had done to assess problems like these – noting the effect of the filler, resin, additives and die geometry. All experiments were carried out in a twin-screw extruder, and a capillary rheometer was used for further characterisation.

When running materials containing either rice husks or sawdust – at loadings of 50% and 60% – Ingenia found that increasing shear rate and wood content helped surface stability in both cases, which heled to reduce edge tearing.

For the resin itself, the company found that those with lower melt index put higher stress on the material – leading to better surface stability.

The company also tested a number of lubricant packages – including multi-stearates and its own formulations – at loadings ranging from 1% to 4%. It found that multi-stearate systems had an antagonistic effect on surface stability. With its own proprietary lubricant systems, it said edge tearing could be removed at loadings as low as 2%.

In future, the company plans to develop new compatibiliser systems to improve physical properties when recycled polymers are used. Other additives will boost adhesion between the WPC core and capstock material, raise flame resistance and reduce water uptake.

WPC additives

Struktol highlighted a number of additives for wood-plastic composites during K2019 – including lubricants, coupling agents and capstocks.

TPW 813 is a coupling agent that claims to offer superior properties compared to traditional

products. As well as providing good flexural properties, it is effective in reducing water absorption, resulting in a more durable product that can withstand many more wetting and freeze-thaw cycles. The additive can be used with any type of lubricant – especially Struktol's TPW 617 lubricant/process aid.

Struktol's products for WPC decking includes TPW 420, a full capstock compound that offers high durability, scratch resistance, adhesion to substrate and processability, with a low gloss surface. In addition, its TPW 230 – a masterbatch version of TPW 420 – is designed to be let down with polyethylene resin.

To further expand the capstock line, Struktol is developing a new line of compounds with a 'soft feel' surface. These compounds offer superior anti-slip properties with an increased coefficient of friction. The focus of these new compounds will be handrails, poolside decking, stairs, ramps and any other applications where a softer surface with better grip and feel is required. They can be

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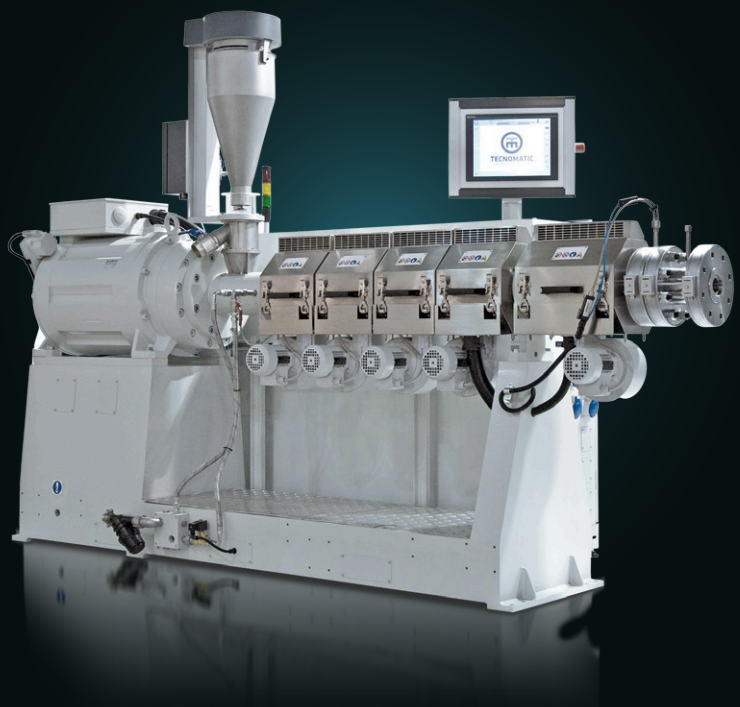

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Right: WPCs are commonly used in decking in place of traditional wood products

supplied with or without Struktol's stabilisation package. The capstock compounds can be tailored to address the customer's needs.

The company also introduced TPW 720, a capstock additive that allows further modification of properties – such as gloss and scratch resistance – based on the customer's specific requirements.

Automated production

Materials handling specialist **Azo** has helped UPM Biocomposites in Germany to automate its production of WPC compounds.

Azo combined automatic mixer feeding with vacuum weighing systems, to streamline production of the compounds. The finished compounds also had to be conveyed and stored in day bins – from which they were supplied to several extruder lines.

UPM currently produces 15 different basic formulations in six colours on these mixing lines.

"From the outset, we wanted a concept for the material fllow that would not restrict us in any way," said Marc Reich of UPM. "This means that we were able to transport all components on all mixing and extrusion lines."

The Flexidos feeding system used in this plant is very versatile. It is typically used for flexible feeding of extruders with new materials, masterbatches, additives and regrind, for making high-quality products. It is suitable for lower and average rates of throughput.

Pneumatic vacuum conveyors convey medium and minor components to the surge bins. Individual components are metered onto the scales in accordance with the formulation and weighed accurately. Depending on the use, the main components can be metered in coarse feed, although the remaining components are weighed with gramme accuracy and added, depending on the proportion, in coarse and dribble feed. Advance weighing can be carried out in parallel to the weighing of bulk components.

Key benefits include: consistent quality, thanks to precise weighing of all components; traceable formulations, with verified formulation composition; and the ability to withstand fluctuations in bulk density.

In addition, the vacuum weighing system handles discharge, metering, conveying, combining and weighing. Bulk components and medium and minor components can be delivered to the mixer using the vacuum weighing systems.

Here, components are suctioned onto conveying scales with an electromechanical weighing device and accurately weighed. The core element

in the system is the multiport valve, developed by Azo. This allows several conveying lines to converge at one point.

Trex expansion

US-based **Trex**, a leading manufacturer of WPC decking and railing, has broken ground on a new manufacturing facility in Frederick County, Virginia.

Trex is adding a new decking plant next to its existing production site to meet continued growth and projected product demand. The new facility is expected to create more than 150 jobs.

"This is an exciting time for us with all signs pointing to continued growth and escalating demand," said Jim Cline, president and CEO of Trex. "We've been planning this for some time and have been eager to break ground and welcome new talent."

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The new facility is part of a US$200 million capital investment programme that will allow Trex to increase production output for future projected growth. In addition to expanding capacity in Virginia, Trex is also installing extra capacity at its Nevada site that began coming online earlier this year. The new lines are scheduled to come online in the second quarter of 2020.

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Multiple benefits

Die technology, machinery developments and new materials are all contributing to advances in multi-layer pipes

The increasing demands on pipe – for properties such as heat resistance, superior barrier or higher strength – have led to an increase in multi-layer pipe technologies.

At K2019, **Tecnomatic** of Italy showcased several die technologies for making multi-layer pipe – including its Venus Multi series. Die heads in its Venus series use multi helical spirals to produce two-, three- or four-layer polyolefin pipes – even in large sizes.

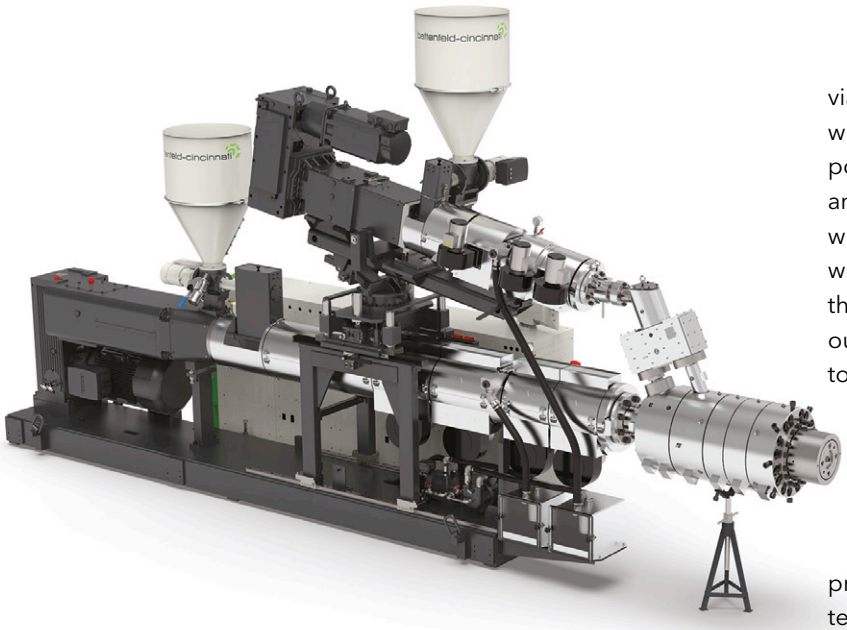
The Venus Multi range has innovative flow channel geometry, which has been calculated in consideration of the raw material being used. The geometry ensures the same behaviour for pressure and distribution of the melt, in all the pipe heads of the range – and at high output, says Tecnomatic.

The new feeding system of the spiral channels helps to reduce working pressure. This helps reduce energy consumption during extrusion – as around 5-10% of extruder power is necessary for pumping. Lower pressure also reduces the increase in melt temperature. In combination with lower residence times, this helps to improve pipe characteristics such as oxidation resistance.

The company has also developed a system that applies an external layer (made of PE, PE 100 RC, PP, PP foamed or any other special material) to the pipe. The system, called Venus Coex-unit, is a radial distribution ring, a flat spiral, where the material flows from external to the centre of the tooling through feeding channels and is then circumferentially distributed. The flat radial distributors are characterised by a uniform volume flow and good layer thickness distribution – as well the absence of weld lines and other weak points.

The Coex-unit can be added to any existing Venus pipehead, but it is particularly useful in multi-layer applications – such as with the new Multi

Main image: Tecnomatic recently delivered a five-layer line to a European producer of plumbing pipe



Above: Battenfeld-Cincinnati's new three-layer Spider NG 250-3 pipe head is suitable for pipes from 110 to 250mm in diameter

Quattro die-head for the production of PE pipes up to 400mm in four layers.

Tecnomatic has also adapted the design of its Athena die heads to improve their flexibility and accuracy.

A modified Athena die was recently delivered to a European producer of plumbing pipe, to make five-layer polybutene and PEX pipe.

In the die, the radial distributors do not have any dead zones or edges where material could get stuck – which aids cleaning and rapid assembly/disassembly. Radial spirals allow low pressure losses and high flexibility in terms of layer structure (thick or thin) and number of layers – while their short flow path leads to reduced residence time and rapid material and colour changes.

The line has a working range of 8-32mm and is characterised by throughputs up to 50 m/min – for five-layer PEX or PE-RT in diameters of 16mm – and up to 40 m/min for most of the polybutene pipes diameters.

Die geometry

Battenfeld-Cincinnati exhibited a number of pipe die technologies at K2019, including its new three-layer Spider NG 250-3 pipe head – which is suitable for pipes from 110 to 250mm in diameter and outputs from 400 to 850 kg/h.

The new pipe head was demonstrated as part of a space-saving piggyback solution. A ConEx NG 54 conical twin screw extruder was mounted on top of a TwinEx 93-34 R parallel twin screw extruder with a pipe head.

The three-layer Spider has a completely new design. Here, the middle layer is distributed via spider-type mandrel geometry. It ensures that a wide range of different materials, such as compounds with high filler content, regrind mixtures and even foaming compounds can be processed without any problems. A spider-type mandrel which offers the same advantages is also used for the inner layer. The flow channel geometry of the outer layer consists of several coat hanger distributors positioned around the circumference and a matching pre-distribution unit supplying them with even flow quantities. In this way, extremely narrow wall thickness tolerances can be achieved.

The system also shows excellent flushing properties. A pipe manufacturer who had been testing the die in practice for some time was satisfied with its low material consumption and narrow pipe tolerances. The Spider NG 250-3 was seen at K2019 for the first time.

X-ray technology

Inoex launched its iXray technology at K2019. The system uses X-rays to measure wall thickness and pipe diameter, with micron-scale accuracy.

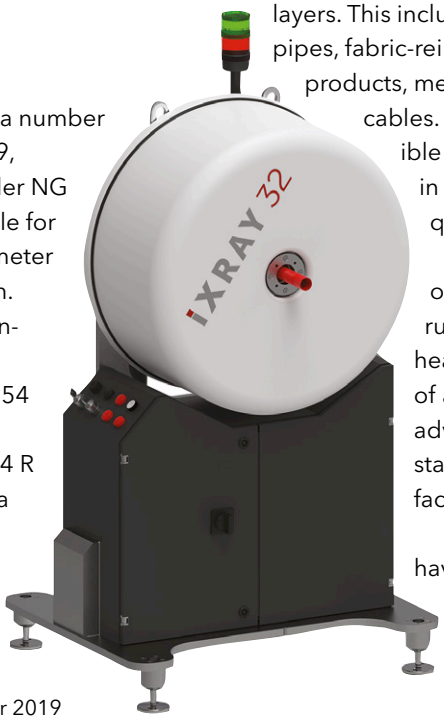
It can be applied to single and multiple layer pipes, tubes and rubber products. The core pieces are X-ray components combined with semiconductor sensor technology. They allow a precise spatial resolution and accuracies in the micron range. Even with high line speeds the X-ray system supplies precise measuring results, on either two or three axes.

Standard iXray systems made by Inoex are designed for pipe dimensions from 0.6 to 110mm.

During development, Inoex focused on wall thickness and diameter measurement for multiple layers. This included aluminium composite pipes, fabric-reinforced pressure tubes, foam products, medical tubes and hoses as well as cables. The main focus is on reproducible dimensional product accuracy in the micron range and thus the quality assurance aspect.

In PVC extrusion, the centring of the extrusion die (such as for rubber tubing) or the thermal die head centring are achieved by way of an additional interface. Another advantage is that it uses the standardised process data interface OPC-UA.

X-ray systems of the iXray line have been designed to protect the operator from any risk. Because of their low radiation



Right: iXray from Inoex uses X-rays to measure pipe wall thickness and diameter with micron-scale accuracy

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Right: Evonik's MLT 4840 multi-layer tubing system uses a polyamide inner layer in place of a fluoropolymer

power, the systems operate well below permitted legal thresholds.

The system can be used in conjunction with iXact diameter-measuring systems, which can make up to 16,000 measurements per second per axis. They are often used for pipe or tube diameter measurement at the end of the extrusion line.

Auto extrusion

Maillefer says that its multi-layer co-extrusion cell provides high enough flexibility to produce modern automotive tubes.

Demand for plastic pipe within the automotive sector is growing, but emission standards can be highly restrictive – meaning that products such as fuel vapour return tubes must have a sufficient barrier to prevent emissions. At the same time, electric vehicles also require tubes that work at raised temperature, in applications such as cooling tubes that keep batteries at the optimal temperature.

Maillefer says that an array of five or six of its single screw extruders – with a multi-layer ECH crosshead at the centre – can be used as the basis to extrude pipes up to six layers. Production flexibility, combined with the possibility of swapping layer positions, gives manufacturers many choices, says the company.

"Mathematically, more than 150 combinations are possible with the five-layer head, while many more are possible with the six-layer version," said Mailleer.

Allowing operators to prepare for the next product run by optimising set-up and clean operations at the head makes for faster product changes. The head's indexing feature allows layer positions to be assigned with a simple twist. Reducing the number of layers to be extruded is made possible by using thicker distributors or by combining extruder flows. The head has an improved design that allow easy removal of parts, which is appreciated during cleaning.

Conductive inner layer

Evonik has developed a conductive, low-extractable multi-layer tubing system for automotive fuel lines – which uses a polyamide inner layer in place of an expensive fluoropolymer.

Its MLT 4840 multi-layer tubing system uses a newly developed grade of polyamide 612 for the inner layer.

Crucially, the system uses aliphatic polyamide in the inner layer. In the past, only aromatic PA grades – and fluoropolymers – had a good enough low-extractable performance.

"This is a special material that we've developed from previously existing grades," said Klaus Gahlmann, director of tubing systems in the company's automotive and mobility division.

The three-year development project began by adding conductive fillers to the material, but in time the plastic itself also had to be modified.

"It's not just about the fillers," said Gahlmann.

The other advantage of using an aliphatic material is that it can be extruded at relatively high speed without suffering a 'sharkskin' effect.

MLT 4840 retains its antistatic properties even after long-term contact with alcohol-containing fuels, and is more cost-effective than systems that use fluoropolymers, said the company.

Alcohol-containing fuels, such as ethanol-containing biofuels, can dissolve components from the inner walls of conventional fuel lines. These substances can clog the nozzles in sensitive fuel systems that use small-diameter nozzles to create an atomised spray of fuel and air for fuel injection, in order to reduce fuel consumption. To reduce this possibility, Evonik has expanded its range of multilayer tubing systems to include some with reduced extraction.

The new material also ensures that swelling effects – which might destroy the conductive effect – are avoided.

Gahlmann added that it is crucial for the adhesive layer to be low extractable – and this material had already been developed for the earlier MLT 4800 system.

Although the system was showcased at K2019, it is already being trialled by customers.

"They are already testing it to their own requirements," said Gahlmann. "It's being assessed on several platforms. We hope it will start being used commercially next year."

The company says that it now has both conductive and non-conductive vers ion of the multi-layer pipe. The non-conductive version is the earlier MLT 4800, launched at K2016.

CLICK ON THE LINKS FOR MORE INFORMATION:

- **www.tecnomaticsrl.net**
- **www.battenfeld-cincinnati.com**
- **www.inoex.de**
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Understanding what causes wear in extruder screws and barrels – and choosing the correct treatment – is key to extending lifetimes and reducing replacement costs

Damage limitation: how to prevent extruder wear

Plastics processing can take its toll on a machine, with many materials capable of causing damage to the screw and barrel of an extruder over time.

For instance, many pipe and profile operations process highly filled PVC compounds in twin-screw extruders because they combine superior mixing with high output. However, the high screw-to-barrel loading can cause adhesive and abrasive wear at the interface – as can the corrosion generated by the chlorinated material.

One way to offset this, and extend the working life of the system, is to use screws and barrels with super-hard surfaces.

"Compatibility of screw and barrel is especially critical in counter-rotating twin-screw extrusion," said Jeff Huskey, director of OEM sales at **Nordson**.

He said that his company's bimetallic barrels with the Xaloy X-800 lining last up to four times longer than those with standard nitrided alloys (Nitralloy), because they provide greater resistance to abrasive fillers and corrosive volatiles. In addition, Nordson recommends use of a tungsten carbide screw surfacing.

Both the X-800 barrel lining and a tungsten carbide screw surfacing (such as Xaloy X-830) are composites consisting of tungsten carbide particles – uniformly dispersed in a nickel alloy matrix. In abrasion tests with 20,000 wear cycles, a Nitralloy barrel with molybdenum screw hard-surfacing had nearly double the wear of a Xaloy X-800/Xaloy X-830 combination. The wear resistance of the Xaloy X-800 barrel was consistent throughout its depth, whereas hardness and wear resistance progressively decreased with depth into the Nitralloy material.

An even greater difference was seen in tests of corrosion in 20% HCl – with the Nitralloy barrel exhibiting more than four times the corrosive wear.

As well as supplying new Xaloy X-800 twin barrels, Nordson can reline worn barrels. Relining protects the original investment in the barrel by extending its working life, and costs much less than a new barrel.

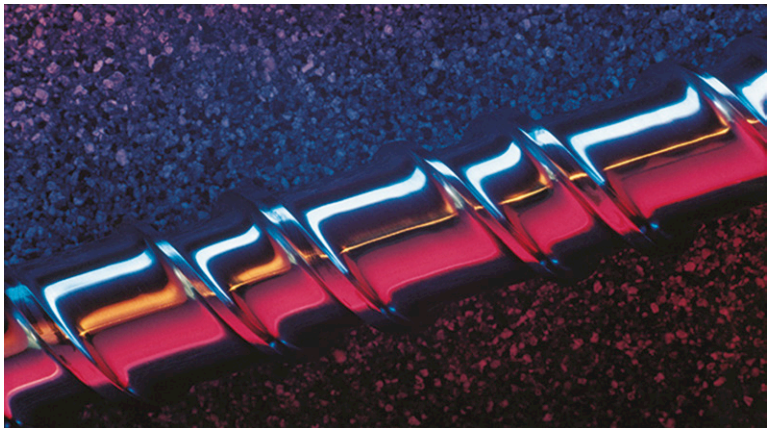
"We produce new twin liners that fit into a bored-out casing," said Huskey. "A perfect custom fit ensures proper heating and cooling of the polymer during processing."

Screw protection

Davis-Standard recently published a white paper explaining some of the factors behind screw wear. The document, written by the company's vice president of extrusion technology, John Christiano, says there are three main causes of screw wear: abrasive, adhesive and corrosive.

"The type and rate of wear depends on many variables that include mechanical alignment of the equipment, the operating conditions used, screw design, polymer chemistry, type of abrasive additives and the materials of construction," he said. ›

Main image: Nordson says that its bimetallic barrels with Xaloy X-800 lining last up to four times longer than those with standard alloys



Above: Davis-Standard says various treatments can be used to lengthen the life of screws

Each type of wear is best handled in a slightly different way.

Abrasive wear is caused by hard particles – suspended in a filled polymer – or small projections from a surface roll or slide under pressure against another surface. The most effective corrective action is to use protective coatings and harder construction materials.

Adhesive wear occurs when there is metal-to-metal contact of two surfaces in relative motion to each other – such as a screw flight and barrel. It is best handled by using borescoping equipment and performing regular maintenance.

Corrosive wear happens when a corrosive material attacks the surface metal, causing pitting and increased surface roughness. It can be caused by corrosive flame-retardants and some grades of PVC. It is dealt with by selecting correct construction materials – or adding coatings – that do not react with the corrosive substance.

Torsional strength

The material used to make the screw needs enough torsional strength to transmit power to the process, resist wear and offer good machinability.

"It would be nice if one material would provide adequate physical properties, wear resistance and deliver a long life, but there is not," said Christiano. "That's why most high-performance screws consist of a base material for the body, a wear-resistant alloy applied to the flights, and a surface treatment."

There are several methods to improve the wear properties of screw flights. These include: heat treatment by flame hardening, for minimum protection; applying a wear-resistant alloy, for moderate to high protection. A popular method for applying alloys is to use the PTA welding process, to add either cobalt- or nickel-based surfacing alloys.

"Almost all of our high-performance screws use this method to minimise wear and maximise screw life," said Christiano.

Wear- and corrosion-resistance of a screw body can be raised with surface coatings, which range from thin metal coatings to high-performance materials – using techniques such as HVOF thermal spraying. This uses the combustion of oxygen and fuel to produce a high-velocity stream that propels powders onto the surface at supersonic speeds.

A range of materials can be used including thermal sprays of stainless steel and nickel-based alloys. Coatings containing tungsten carbide have also shown good results.

"These processes are needed when traditional methods have been exhausted due to process limitations and expense," said Christiano. "Other technologies such as vapour deposition and titanium nitriding have been used in a limited number of applications."

Tailored service

CA Picard has developed tailor-made products and services for preventative maintenance for production improvement. These include a barrel measurement device (BMD) for providing accurate barrel wear information and analytical reports.

In addition, the company has developed the flexible dismantling system (FDS) with PLC control, to dismantle screw elements from the shafts efficiently – with full protection of the screw elements and shafts, without the risk of injury to workers.

The company also offers a barrel repair service, giving customers an overhauled barrel without the need to manufacture a new external body.

The used, worn barrel is examined and the flow through the cooling channels is tested. At this point, a decision is made as to how to proceed with the general overhaul.

On receipt of the order, the worn liner is removed, and cooling channels are flushed and undergo pressure testing. As the repair progresses, bores and threads are re-machined and the entire external body is cleaned using a suitable blast medium. Once the external body has been restored, the new wear liner is inserted into the heated external body and the sealing faces are ground.

The final stage is the outgoing inspection, which is performed using a 3D measuring instrument in a climate-controlled room. At this point, all geometric data is checked. Before delivery, the refurbished barrel is checked for leaks in the cooling channels in another pressure test.

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- **www.nordson.com**
- **www.davis-standard.com**
- **www.capicard.de**

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PEX pipe was recently used to refurbish an entire district heating system in the UK – and also played a major role in making an entire community in the USA carbon neutral

Taking the heat: PEX pipe in construction

Cross-linked polyethylene (PEX) pipe is gaining in popularity as installers realise it is easier to install than traditional steel piping systems – and can help sustainability.

For instance, PEX pipe is playing a part in making an entire 7,200-home community in Texas carbon neutral.

Taurus, the developer of Whisper Valley in Austin, Texas decided that the entire 2,000-acre community would be 'Net-Zero Ready'. All structures will be ground source geothermal and solar equipped to meet the carbon neutral standard adopted by the city's Municipal Building Code. The US$2 billion development also includes apartments, commercial space, schools and other buildings. The developer says it will be the largest zero-energy capable housing community in the USA.

A key component in achieving this is the geothermal – or geoexchange – cooling and heating system, and its underground distribution piping system.

Each of the 237 homes in Phase I of the project is equipped with a **Rehau** Raugeo PEX-a double U-bend pipe loop and a ground source heat pump. More than 95,000m of the pipe was used.

All builders in Whisper Valley must hook up to EcoSmart's GeoGrid, a five-mile loop of underground distribution piping that links each home to a geoexchange network, engineered by B2E Consulting Engineers. The system is predicted to reduce heating/cooling energy costs for homeowners by up to 65%, compared with conventional air-source heat pumps.

"This is a great example of the use of plastic tubing for geo-exchange loops, and all the benefits that ground source systems deliver," said Lance MacNevin, director of engineering for the building and construction division of the **Plastics Pipe Institute** (PPI). "The PEX piping is tough and durable and will provide decades of reliable service."

He added that the Rehau double U-bends increase the output of each borehole by up to 30% compared to single U-bends. This reduced the required depth of each borehole, as well as the overall number of boreholes.

"It also cut drilling costs and the number of days spent drilling on the Whisper Valley jobsite," he added.

The project was named the 2019 PPI project of the pear in the building and construction division.

The design incorporates boreholes around 100m deep, into which the Rehau pipe loops were inserted. Boreholes were grouted after pipe insertion. As with all geothermal systems, fluid

Main image: The Whisper Valley project uses PEX pipe within a geothermal heating and cooling system

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Right: Uponor's PEX pipe was used to upgrade a district heating system at the Market Hill housing estate in Scunthorpe, UK

circulates through the pipes, exchanging heat to and from the earth for cooling or heating.

Each PEX vertical pipe loop connects to a system of horizontal pipes. This larger integrated 'geo loop' is augmented by two 250-tonne cooling towers for meeting peak cooling loads during periods of high ambient temperatures.

"This project shows how PEX pipe in a geoexchange application can help reduce the overall carbon footprint by minimising the energy required to heat and cool homes," said PPI. "The developer providing the geoexchange network – and requiring builders to connect to it – is game changing. It removes the primary barrier that prevents more widespread adoption of geo-exchange systems."

PPI added that Taurus, the developer, plans to take the concept to other locations.

"I'm sure other developers will duplicate it, especially as more municipalities set Net-Zero targets," said PPI.

To further support the geothermal market, PPI has established the geothermal steering committee within its building and construction division.

MacNevin said: "We promote the adoption of geothermal technologies to help reduce energy consumption for heating and cooling buildings, which saves owners money. Other benefits of ground source systems are better reliability and building resiliency, with no exposed outdoor components."

Phil Schoen, president of Geo Enterprise – which installed the system – said: "Whisper Valley's district GeoGrid is already performing 20-30% better than projected. The system will gain efficiencies as it expands, and the team works to wring out every possible BTU."

Community upgrade

Uponor has supplied a revamped PEX-based pipe solution to a social housing project in Scunthorpe in the UK.

Originally built in the 1960s, the Market Hill housing estate is made up of 10 maisonette blocks and three high rises with 76 flats in each building. Heating and water was supplied by a district heating system, but due to excessive corrosion and leaks, the piping had to be replaced. This full system refit had to be undertaken with minimum disruption to the 350 residents and with no relocation into temporary accommodation.

The original heating system used conventional steel pipe systems in ducts. In the 1990s the system was updated with pre-insulated steel. However, this only lasted a further 20-25 years – and recently saw a number of system failures and maintenance problems. This is when housing provider Ongo

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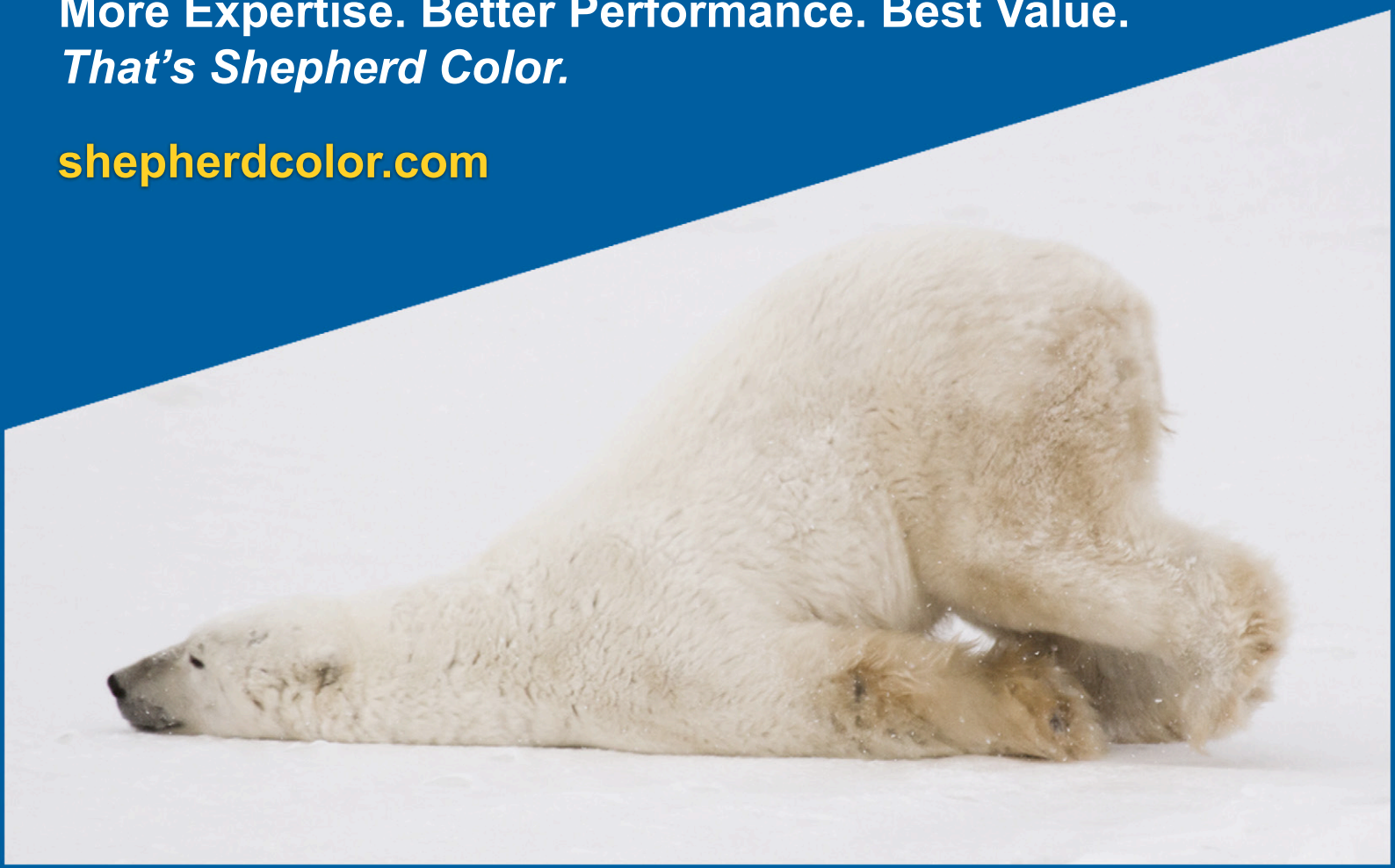

Homes decided the full district heating system needed replacing.

Using more steel-based piping would have required residents to be relocated – which was not an option. So, the contractors chose to use Uponor's Ecoflex pre-insulated pipe systems.

The heating network consisted of a new plant room installation, plant room piping and replacement of the full district heating system. Ecoflex pre-insulated pipe was a perfect fit, due to its increased lifespan and potential for long, joint-free runs – which made it quicker and easier to install.

Another reason for choosing it was that it could be run alongside the existing mains, and work in tandem with old mains that were still active. This kept building work disruption to a minimum – and residents in their properties.

The installer split the pipe order so the products were only delivered when required. This meant that for a five-week period – between October and November 2018 – pipe connections were undertaken every 12m across the total pipework run of 1,500m.

In total, 2km of pipes were installed into the buildings.

"This was a challenging scheme with over 300 residential properties on the site relying on the district heating supply to continue providing heating and hot water on demand," said Richard Farrow, managing director of Sutcliffe Consulting Engineers, which designed the system. "It was not possible to shut the existing heating system down for more than a few hours at a time. Successful design of the system meant it could be installed alongside the existing heating system, requiring only minimal shut down periods to switch over. The Uponor Thermo Twin pipework was selected for its quality and ease of installation."

Below: Phase I of the Whisper Valley project used more than 95,000m of Rehau's Raugeo PEX pipe

Fire rating

US-based **Viega** says that its PureFlow PEX pipes

Right: PEX is commonly used in fire sprinkler systems

and fittings have been listed by **Underwriters Laboratories** (UL) as approved for use in exposed fire sprinkler systems in basements.

The UL listings mean builders and contractors can now use PureFlow throughout an entire residential fire sprinkler system. The listing eliminates the need for contractors who have used PureFlow PEX throughout a house to join it to pipe of another material in the basement.

"Contractors who prefer PureFlow for its easy handling, fast connections and reliability can save time and money now that they can use the system throughout the entire house," said Seth Larson, product manager at Viega.

The listings cover two types of ceiling. PureFlow can be installed and left exposed in wood joist ceiling assemblies when a number of conditions are met, including: joists are of dimensional lumber, engineered wood, wood I-joist or open web wood joists (wood floor trusses); and joists can be exposed after installation. It can also be installed exposed across finished ceiling assemblies, when meeting other conditions.

In both cases, conditions include: metal pipe hangers spaced at a maximum of 610mm on centre; and residential automatic sprinklers have a maximum activation temperature rating of 165F (68°C).

Viega says that PureFlow is the only PEX fire sprinkler system with an easy alignment bracket that eliminates the need for measuring when hanging pendants.

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- **www.plasticpipe.org**
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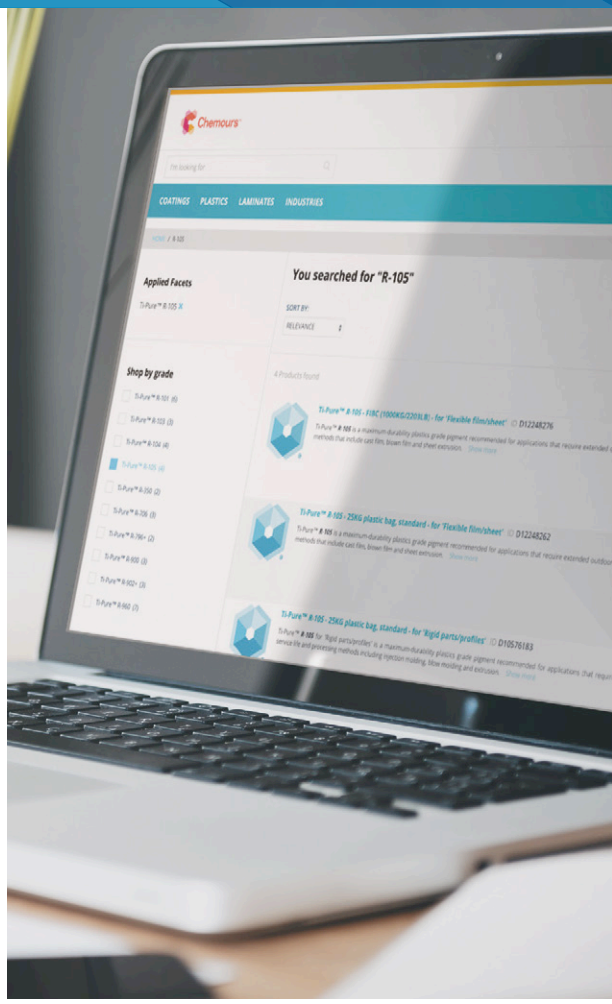

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K2019 saw a greater participation from foreign visitors and an unmistakable focus on sustainability – including many variants on the theme of recycling plastics

Sustainability: the key theme from K2019

After eight days – and what for many people has been many miles of walking between halls – the giant K2019 exhibition is over.

Sustainability was a key theme at this year's show, with many exhibitors showcasing technologies such as chemical and mechanical recycling and bioplastics.

Ulrich Reifenhäuser, chairman of the exhibitor advisory board at K2019, said: "Never before has the industry addressed an issue so unanimously – and worked on solutions so consistently – as is the case now, in the fields of environmental compatibility, saving resources and avoiding waste."

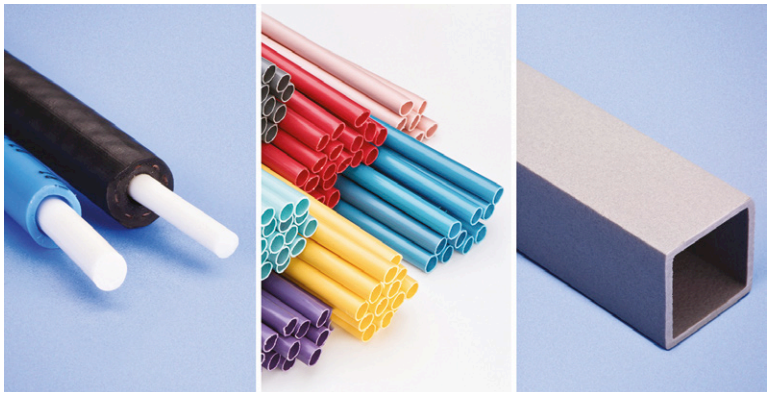
The proportion of foreign visitors at this year's show exceeded 73%, compared with nearly 71% in 2013. Asia accounted for around 40,000 visitors – with large contingents from India, China and Japan. Almost 20,000 visitors came from North and South America – a 7% increase compared to 2016. There was a marked increase in the number of visitors from Brazil, said the organiser.

At the same time, exhibitor numbers rose from 3,285 (in 2016) to 3,330 at the latest edition of the show.

Messe Dusseldorf, which organised the exhibition, said there were 224,116 visitors this year – about 2.6% lower than the official figure from 2016 (which was put at 230,000). This compares with 218,000 visitors at K2013, said the organiser.

The next K show will be held on 19-26 October 2022.

The following pages contain a selection of new launches from this year's show. The section concentrates on machinery, ancillary and materials developments – but is not exhaustive. Many other technologies were launched at the show. Some will be featured in future editions – within their relevant subject areas. ›



Above: BASF's new Ultradur grade can be used for extruded products such as pipes and profiles

BASF has developed several extrudable grades of its Ultradur PBT.

Until now, the melt strength of PBT was not high enough to allow it to be extruded. By connecting and branching the polymer chains – using tailor-made additives – BASF has raised the high melt strength of the grade, called Ultradur B6551 LNI. The company says it can be used to make pipes, profiles and mandrels.

The material has high melting point, good crystallinity and dimensional stability – as well as a good vapour barrier, said Tatiana Ulanova, of BASF's extrusion, medical and industrial manufacturing division.

"The main advantages of PBT are its higher mechanical properties and temperature resistance," she said.

BASF modified one of its existing additives, to join short polymer chains together in order to boost the melt strength, she said.

› **www.basf.com**

Battenfeld-Cincinnati exhibited a number of pipe die technologies at K2019, including two Spider pipe heads for PVC processing (for mono- and multi-layer pipe). It also showed a fast-dimension-change (FDC) pipe head – which allows dimensional changes during production.

The new generation of Spider heads offer the advantages of low material consumption and narrow tolerances resulting from optimised layout, says the company.

The Spider NG 160 mono-layer head is suitable for pipes with dimensions ranging from 32 to 168mm and output rates from 250 to 800 kg/h. At K2019, the mono-layer Spider was flanged onto a conical ConEx NG-65 twin screw extruder.

The mono-layer pipe heads have also been completely revised. All pipe heads in the Spider NG series will now be available in six sizes for pipe diameters ranging from 6 to 630mm. Using flow simulation in the redesign of the mono dies has helped to improve their performance. From this mono series, a model is already being tested, says the company.

The company has also developed a new generation of Spider pipe dies for twin-strand lines.

The three-layer model, the Spider NG 250-3, is covered in our multi-layer pipe feature elsewhere in the issue.

Battenfeld-Cincinnati has also produced a pipe extrusion die which it says has the largest adjustable melt gap – allowing pipes of 1,200-1,600mm in diameter to be made without nozzle change.

With additional extension kits, it is possible to produce pipes ranging from 400 to 1600mm in diameter. The pipe head, which was exhibited at K2019, has since been delivered to a Mexican customer.

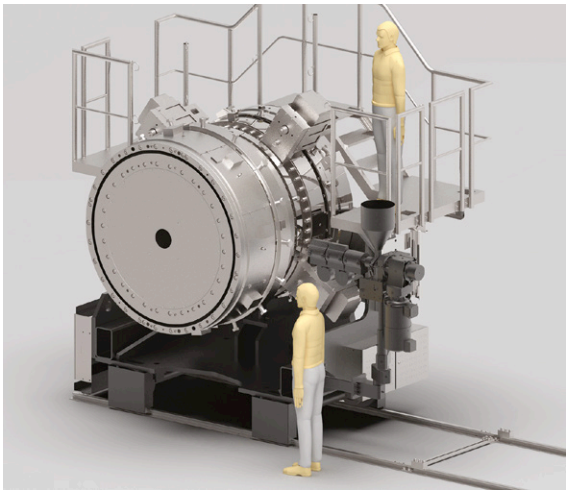
Previously, Battenfeld-Cincinnati supplied pipe dies with adjustable melt gaps in sizes ranging from 20 to 1200 mm for many applications.

"An adjustable melt gap always makes sense, especially if the pipe manufacturer wants to produce different pipe dimensions on its line and to respond fast and flexibly to market trends, or to make frequent dimensional changes," said the company.

For the extrusion of pipes in small dimensions, the adjustable melt gap is not used for dimensional change, but offers more flexibility to cope with the typical swelling behavior of every material whenever a material change is made. This helps to achieve narrow tolerances and high pipe quality.

Another advantage of the adjustable melt gap is safe handling. Especially with large pipes, such as those within the 1,200 to 1,600mm diameter range (such as those produced by the Mexican customer), a nozzle change – which is necessary in conventional dies – always involves a special effort and involves a safety risk. The automatic adjustment helps overcome these drawbacks.

› **www.battenfeld-cincinnati.com**



Right: Battenfeld-Cincinnati says its new extrusion die can make pipes of 1,200-1,600mm in diameter without nozzle change

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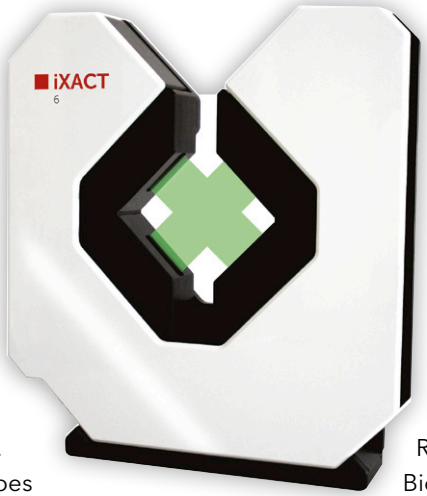

Right: Inoex showed a number of systems at K2019 including its iXact, which can make 16,000 measurements per second

Inoex launched its iXact system at K2019, which makes 16,000 measurements every second to determine pipe diameter with high accuracy.

Using semiconductor sensor technology and high-power LEDs, it can measure strongly vibrating tubes thanks to the high measuring sequence frequency. The high-power LED make measurement of most transparent materials very simple.

As a 'plug & play' solution, it does not need any calibration and offers a difference function which registers any sudden variations. It can detect irregularities such as knots and necking on the measured extruded surface.

An extra camera helps to compensate measuring errors due to inclination. This increases the accuracy of the diameter measurement.

The two- or three-axis measurement operates at high speed and with a high precision – and is available in three different versions: for small-diameter products; for diameters up to 30mm; and for diameters up to 120mm.

The robust design ensures that knocks or temperature changes do not have any effect on measuring results.

At the same time, Inoex launched its iXray system, which measures both wall thickness and diameter – for both mono- and multi-layer pipe – in the micron range. More details on this can be found in the 'Multi-layer pipe' feature on page XX.

Other products on show at K2019 included: Warp XXL, which can measure the dimensions of pipes up to 3,500mm in diameter and is based on radar technology; Quantum 360, which uses terahertz technology; and Aurex, which uses ultrasonics.

› **www.inoex.de.**

Below: Koch-Technik's Ekon is available in eight sizes, with outputs up to 2,000 m³/h

Inovyn has developed its latest generation of PVC under the brand name Biovyn – as it is derived from sustainable materials.

Made at its Rheinberg plant in Germany, Biovyn is made using 'bio-attributed ethylene' – a renewable feedstock derived from biomass that does not compete with the food chain.

It is certified by by the Roundtable on Sustainable Biomaterials (RSB) as delivering a 100% substitution of fossil feedstock in its production system, enabling a greenhouse gas saving of over 90% compared to conventionally produced PVC, says the company.

"Through our sustainability programme we are developing a new generation of PVC grades that meet both the rigorous product quality and performance needs of our customers, whilst moving us closer towards a circular, carbon-neutral economy for PVC," said Filipe Constant, business director of Inovyn. "There is growing demand for a specialist, renewable PVC that decouples its production from the conventional use of virgin fossil feedstocks."

The material is expected to have many applications across a range of industry sectors, including specialised end-uses such as automotive and medical.

› **www.inovyn.com**

Koch-Technik introduced a new type of dry air dryer – under the name of Ekon – at K2019.

The company has combined the advantages of its CKT and Eko drying concepts into the new dryer. Ekon is available in eight sizes, with outputs ranging from 110 to 2,000 m³/h.

The concept of a heat exchanger with piping system – taken from the Eko dryers – has been improved in new series. As the heat is recovered, energy consumption is reduced by 20-30%, depending on the material drying temperature.

In addition to the standard blower with frequency regulation (from the construction volume of 300 m³/h) the new dryer is also equipped with Koch Öko's patented energy management, which adapts to the drying process to save energy and protect the material, for maximum energy savings. By combining dew point control, Öko equipment and blowers with frequency regulation, up to 50% energy savings can be achieved when drying the granulate, says the company. ›

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Thanks to the modular system from Koch, various drying containers with capacities of 20-600 litres can be integrated into Ekon.

Safe operation of the dryer is ensured by micro filters, overload protection, air check and temperature limiter. The drying process is constantly monitored via sensors. Dry air with a dew point of -55°C can be produced to absorb moisture from the granulated plastic and to achieve the required residual moisture content of the dried material.

Using an Ethernet connection, the device can be connected to a corporate network to control the drying centrally. The new dryers are also equipped with the OPC-UA open interface standard, allowing data exchange between production machines and peripherals independent of the manufacturer.

› **www.koch-technik.com**

Maillefer presented a number of its technologies at K2019 – including a range of coilers, and machinery to make irrigation pipe.

Its KWA coiler is for medical applications. Its main value is in the mechanisms and precision machined parts of its two stainless steel turrets. The knowhow programmed into the traversing process overcomes the challenges of planetary rotation during transfers and tube acceleration dynamics, says the company. The unit keeps pace with lines running at speeds over 300 m/min. It can wind medical tube into coils of 620mm in diameter.

It also offers the KWD, for reeling blown fibre microduct and some automotive tubes. A new multi-axis traversing system guides the tube to form highly regular lays, even on irregular wooden reels. Along with a redesigned dancer, the traversing system maintains full control even at line speeds of up to 300 m/min.

The KWI, for thin-wall micro-drip irrigation, has a smart traversing process that anticipates and compensates for the effect of reversing lay directions. This eliminates gaps between the wound tube and the reel flange – to give a perfectly full reel from edge to edge. The reeler reaches up to 400 m/min and is available in rear or lateral reel unloading versions.

Maillefer also presented information on two new extrusion lines in the micro-drip irrigation portfolio. The first produces thin-wall laterals with mini-flat emitters that is already in the field. The second is for thin-wall continuous labyrinth tape that is undergoing final proof tests before customer delivery. Both are complete systems.

"These lines broaden our portfolio, giving us the responsiveness needed to meet varying customer demands," said Ernst Geider, sales director for pipe and tube at Maillefer.

The company also showed its Bluebox – an industry 4.0 data storage system developed for high-speed acquisition and storage from all levels.

› **www.maillefer.net**

Metravib, a specialist in dynamic mechanical analysis, has improved DMA and fatigue testing by extending the capabilities of its DMA+ series.

Fully automated DMA testing in shear, compression and tension

Xpander is an automated specimen handling system that is designed to boost the productivity of the DMA+ series and can provide tests round the clock in compression, tension and shear.

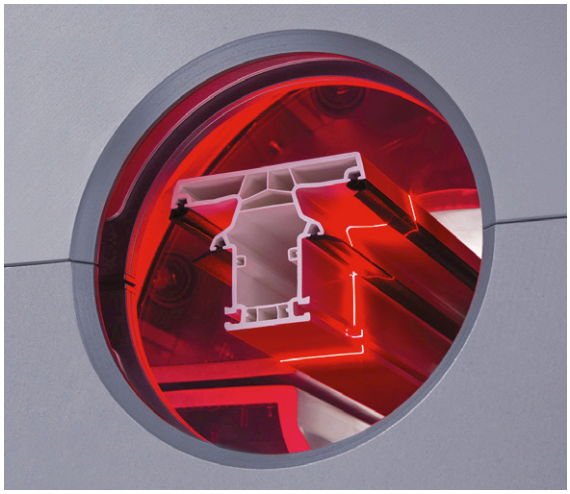
The DMA+ series testing capabilities are extending with a brand new Multitest crack growth software module coupled to a motorised video camera. Using specimens up to 80mm wide, it is possible to follow up to four cracks in one single test. The crack length measurement can be performed with a resolution better than 2 microns.

"Xpander and the new DMA+ series have been designed taking account of industrial expectations in terms of accuracy, performance, productivity and ergonomics, as expressed by worldwide leaders in the rubber and polymers sector. With 50 years of experience in the field, we are the ideal partner," said Hugues Baurier, worldwide sales manager.

› **http://metravib.acoemgroup.com**

Pixargus has developed a device that combines dimension measurement with surface inspection. Its iProfilControl (iPC) can be used to check a variety of products, including window profiles, cable conduits and skirting boards – at high extrusion throughput rates.

Flaws occurring during production can be detected early and corrected in real time. This saves feed material and reduces out-of-spec



Right: The iProfilControl from Pixargus (iPC) combines dimension measurement with surface inspection at high extrusion throughput rates

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products and costs.

Pixargus has adapted system capacity, the range of functions and the hardware to meet the requirements of the process. Starting with a four-camera model, the system can be scaled up to six or eight cameras, as required, to meet the needs of the process situation.

iPC S is the most compact solution for inspecting all visible surfaces. Special light-edge elements ensure that the measuring field is homogeneously lit, allowing the camera sensors to capture and process irregularities and defects that were difficult to detect in the past – including pinholes, pores, scratches, cracks and grooves.

iPC Dimension (DX) gives 360° geometry measurement – including widths, gaps, angles, radii and shapes.

"It detects even most minute deviations from the target contour thanks to its eight laser line sensors watching closely the dimensions of the inspected product," said the company.

The high number of optical sensors is needed to capture the complex geometry of the clamping grooves, which can only be measured with sufficient accuracy with cameras arranged at different angles and positions. The models of the basic series come with a number of features known from the larger ProfilControl 7. The hinged arrangement of the sensor head securely prevents the measuring field from being affected by parasitic light effects.

At K2019, the company also launched its AllRounDia Dual Vision – which it says is the first single-unit system that can perform complete contour measurement and surface inspection at the same time.

The system, which has a compact design, measures and inspects pipe, tubes and cables with a 100% defect detection rate, says the company.

The hardware and software from the company's ProfilControl 7 technology have been adapted to the measurement of contoured products. The system measures around the complete circumference of the products using a single sensor head.

AllRounDia DV gives gapless, 360° measurement of round and oval contours. It does this by using a camera-based, laser-triangulation method. While conventional, axis-based measurements using the shadowing method cover only six single points, AllRounDia's optical sensors capture 8 million pixels, says the company.

"Each individual point can be decisive for the quality of the product," said Jürgen Philipps, managing director of Pixargus. "Although the single-point method is very accurate, it does not capture the area between the points, and detects only defects of relatively large topographic extension."

For a 1mm defect on a product 10mm size, inspecting at only six spots would leave 90% of the surface uninspected. AllRounDia, however, inspects each point with the same level of reliability and repeatability, he says.

"This is gapless inspection in the true sense of the word."

The specially developed lighting concept ensures that the field of vision and measuring field are homogeneously lit. For this reason, flaws in the material – such as fissures, inclusions and other high-contrast defects – are reliably captured.

› **www.pixargus.com**

Although extruded plastics are not often used in solar energy farms and wind turbines, **SABIC** has developed one application that fits here.

It has developed protective ducts made from its Vestolen A Rely 5944HT – a PE100 grade – that can operate at elevated temperatures and for an extended lifetime. It is used to protect the high voltage underground cables that lead from the installation.

"It's also cost-effective for customers as it allows for trenchless and sand-less installation across geographic landscapes," said the company.

Separate to this, the company highlighted drip irrigation systems – made from its LLDPE and HDPE materials – that supply water to where it is needed for crop growth.

› **www.sabic.com**

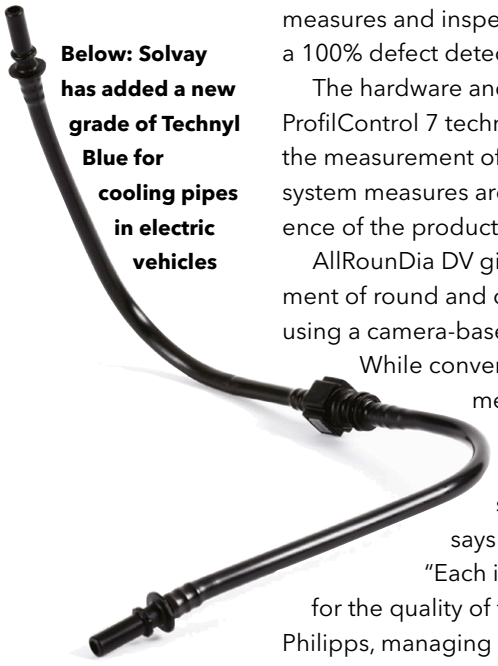
Solvay Performance Polyamides has added a new grade to its Technyl Blue range of PA66/PA610 copolymers.

The extrudable material, which offers high chemical resistance at raised temperatures, is aimed at air conditioning and cooling lines for electric vehicle battery and engine systems.

"Electrified vehicles present an increased number of complex interconnected cooling systems and demands more of our materials offering," said Didier Chomier, global marketing manager for automotive at the company. "Our Technyl Blue range has all the assets to prove itself in the electric vehicle market."

The material – along with other Technyl Blue extrudable grades – offers a good price/performance ratio compared to metals like aluminium, and other polymers such as PA12.

› **www.technyl.com**



Below: Solvay has added a new grade of Technyl Blue for cooling pipes in electric vehicles

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Above: Tomra showed several of its sensor-based sorting solutions at K2019, including Autosort Flake

Tomra develops collection and sorting systems that optimise resource recovery and minimises waste. Its sensor-based sorting solutions – including Autosort, Autosort Flake and Innosort Flake – were on show at K2019.

Volker Rehrmann, executive vice president of Tomra Recycling & Mining, said: "Continuing to use our resources in an unsustainable and inefficient way should no longer be an option. At Tomra, we continue to develop new sorting solutions."

The Innosort Flake, seen at the show, is a good example of "positively impacting and purifying the recycling process", he said. Since its launch earlier this year, it has shown to be a good dual-sorting solution for plastic recovery facilities – sorting plastic fractions of 2-12mm by colour and simultaneously by polymer types. This means that large amounts of contaminants can be removed – and the potential loss of PET flake material can be significantly reduced.

This all-in-one solution with ultra-high resolution and specialised sensor configuration offers high performance results.

"It's an economically favourable sorting solution providing a quick return on investment and scalable flexibility," said the company.

The company is also developing ways of further improving the sorting process. Based on improvements in collecting and managing large amounts of data – and the development of artificial intelligence – Tomra has developed deep learning software for sensor-based sorting.

The software can learn individually from a large amount of collected data, equalling or even surpassing sorting results achieved by humans and typical machines, it says. By combining deep learning models with Tomra's sorting solutions, objects that could previously not be separated can now be sorted with high purity levels, it claims.

"In this regard, deep learning is considered as a promising approach when it comes to addressing the increasing challenges in waste sorting, such as new waste streams," said the company.

› **www.tomra.com**

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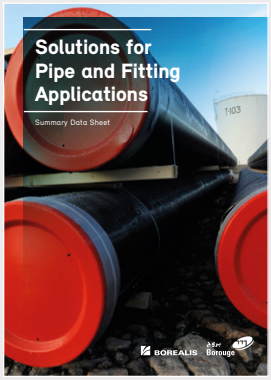
BOREALIS: PIPE POLYMERS



Borealis has been a key supplier to the pipe industry for more than 50 years. This six-page brochure details its full range of PE and PP pipe resins for production of pipes and fittings for a wide variety of infrastructure applications.

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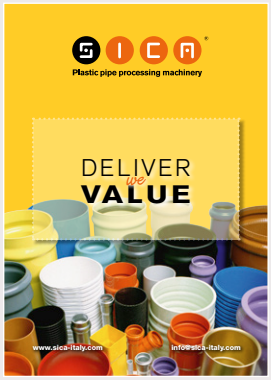
SICA: PIPE PROCESSING



This brochure from Sica covers the company's full range of performance pipe finishing equipment including its novel TRS-W cutting and chamfering, Unibell electric belling and robotised packaging machines.

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HEXPOL: DRYFLEX TPE

The Dryflex family of TPEs from Hexpol TPE add soft touch appeal, function performance and product safety features in a range of consumer, automotive, industrial and packaging applications. Find out more in this brochure.

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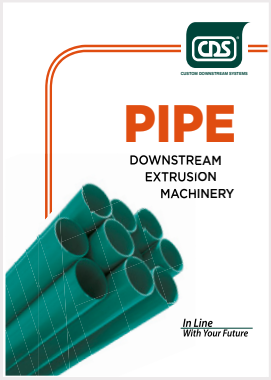

This 12-page brochure details the main features of CDS' pipe capabilities, including vacuum tanks, spray tanks, haul-offs, swarfless cutters, planetary saws and pipe collection equipment.

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UNICOR: PIPE CORRUGATION

This brand new 48-page brochure from Unicor provides detailed insight into the design, production, applications and advantages of corrugated pipes. It includes specification data on the company's wide range of pipe corrugation equipment.

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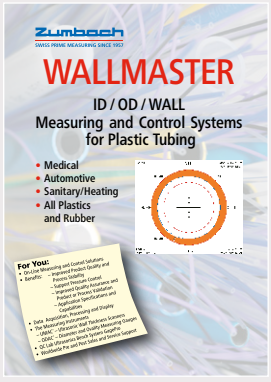
ZUMBACH: MEASUREMENT CONTROL



This eight-page brochure details the main features of Zumbach's Wallmaster measurement and control system for improving product quality, process stability and data capture in plastic tube and pipe extrusion applications.

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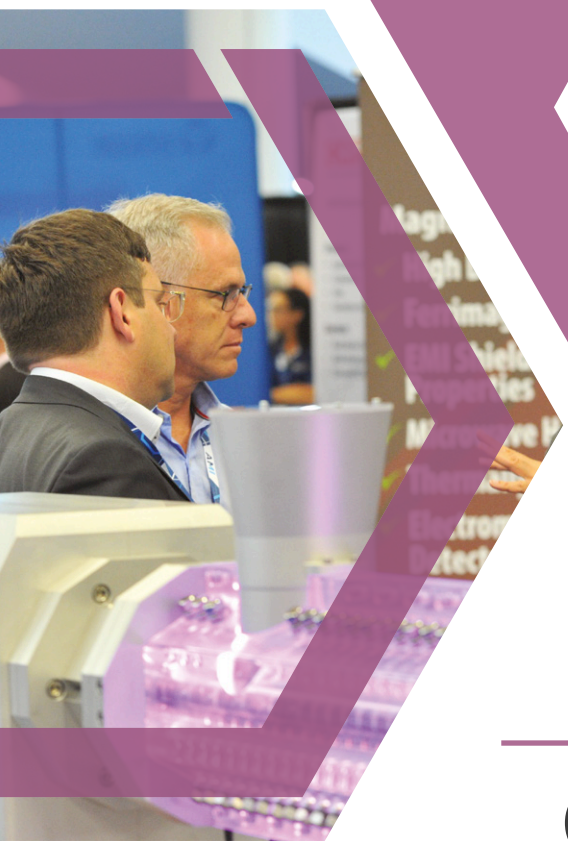

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WEAR-RESISTANT PLASTICS 2019

The second Wear-Resistant Plastics conference takes place in Dusseldorf, Germany, on 11-12 December. The event focuses on the critical area of polymer tribology and explores how wear-optimised plastics can open up new applications.

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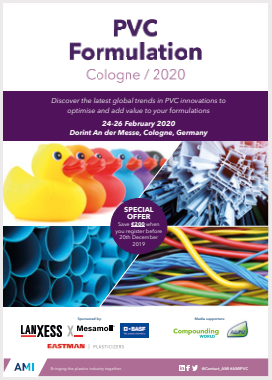
PVC FORMULATION



Taking place in Cologne, Germany, on 24-26 February 2020, AMI's 12th PVC Formulation conference will expose the global trends influencing the flexible and rigid PVC industry and explore regulation, additives, materials and processing.

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CABLES 2019

AMI's 20th Cables conference takes place on 3-5 March 2020 in Dusseldorf, Germany, providing a forum to learn about the latest materials, testing procedures, regulatory requirements and cable manufacturing processes and applications.

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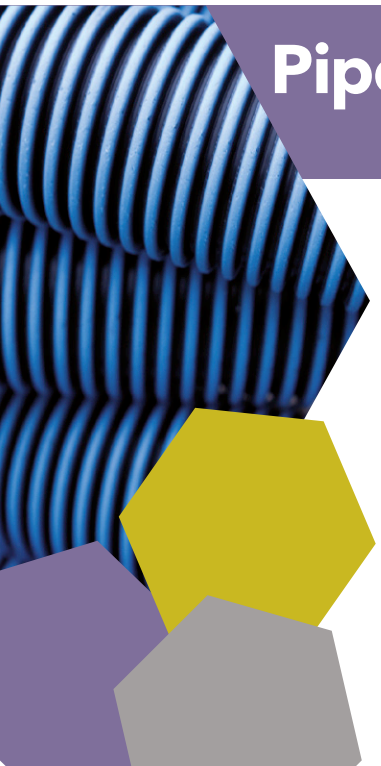
Sales (2018):	Around €3.5 billion
Profile:	Founded in 1948, Rehau began with one extruder, making products such as shoe welting, garden hoses and automotive components. In 1958, it extruded its first window profile – and its first magnetic gasket system for refrigerator doors. Another extrusion innovation was its first radiant floor heating system using PEX pipe.
Product lines:	The company has five divisions, which deal with windows, buildings, furniture, industrial and automotive. The first two are of most relevance to pipe and profile extruders. Within the windows division, its products include the Geneo system, which is made from fibre-reinforced material. Its Rau-Fipro X core material means that windows require no steel reinforcement. In building, Rehau produces a number of piping systems, including its Rautherm PEX product. It has been used in the turf heating systems at eight of the 12 venues for last year's World Cup in Russia.
Factory locations:	Rehau is present at 170 locations in 54 countries and has many production plants across a range of industries. The company says that it has more than 40 production plants across the world, including many across Europe, North and South America, Africa and Asia. Within pipe and profile, these include: two plants in South Africa; one in Blaenau Ffestiniog in Wales; a plant in Manizales, in Colombia; and its Tripitis pipe plant in eastern Germany, which is being expanded.

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



Pipe and Profile EXTRUSION FORTHCOMING FEATURES

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

January/February 2020
Engineering plastics & composites
Screenchangers/melt filtration
Titanium dioxide trends
Mixers

March 2020
Screws & Barrels
Polyolefin developments
Computer modelling software
Laboratory extruders

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

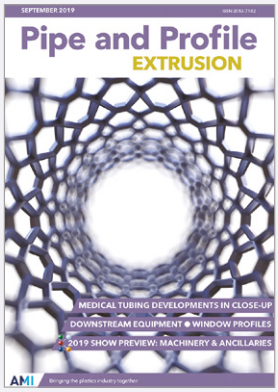
For information on advertising in these issues, please contact:
Claire Bishop: claire.bishop@ami.international Tel: +44 (0)1732 682948
Levent Tounjer: levent.tounjer@ami.international Tel: +44 (0)117 314 8183

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

Pipe and Profile
October 2019
The October edition of Pipe and Profile Extrusion magazine looks at the latest developments in materials handling equipment. It also details some innovations in pipe inspection and PVC-O technology, as well as previewing the K2019 show.

› CLICK HERE TO VIEW



Pipe and Profile
September 2019
The September issue of Pipe and Profile Extrusion magazine explores the latest developments in medical tubing, window profiles and downstream cutting systems. Plus, a preview of the innovations in store for extruders at K2019.

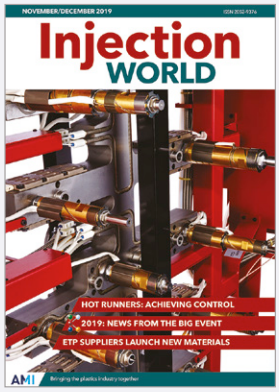
› CLICK HERE TO VIEW

Compounding World
November 2019
The November edition of Compounding World looks at the sustainability drive in carbon black production, delves into the world of mixing technology and surveys the latest in polymer reinforcements and packaging additives. Plus: news from K2019.

› CLICK HERE TO VIEW

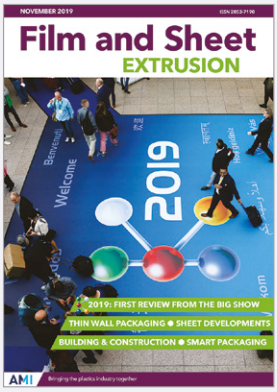
Plastics Recycling World
September/October 2019
The September/October edition of Plastics Recycling World explores a new sorting technology that uses watermarks to identify polymers. Plus, a look at the latest initiatives in rigids recycling and a preview of K's innovations.

› CLICK HERE TO VIEW



Injection World
November/December 2019
The November/December edition of Injection World takes explores new developments in hot runners and engineering thermoplastics. It also examines some of the latest automotive applications and details innovations on show at K2019.

› CLICK HERE TO VIEW



Film and Sheet
November 2019
The November edition of Film and Sheet Extrusion magazine looks at intelligent and thin wall packaging developments. It also explores the latest sheet and construction innovations and reviews the K2019 show.

› CLICK HERE TO VIEW

Take out your own FREE subscriptions to any of the magazines. Click on the logos below to simply register on-line.

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

GLOBAL EXHIBITION GUIDE

2019	**25-28 November**	Plastivision Arabia, Sharjah	www.plastivision.ae
	27-29 November	Plastics & Rubber Vietnam	www.plasticsvietnam.com
2020	**13-16 January**	Saudi Plastics & Petrochem, Riyadh	www.saudipp.com
	16-20 January	Plastivision India, Mumbai, India	www.plastivision.org
	21-23 January	Swiss Plastics, Lucerne, Switzerland	www.swissplastics-expo.ch
	28-31 January	Interplastica, Moscow, Russia	www.interplastica.de
	9-11 March	Plast Alger, Algiers, Algeria	www.plastalger.com
	11-13 March	Expo Plasticos, Guadalajara, Mexico	www.expoplasticos.com.mx
	26-28 March	MECCSPE, Parma, Italy	www.mecspe.com
	21-24 April	Chinaplas, Shanghai, China	http://www.chinaplasonline.com
	3-4 June	Plastics Extrusion World Expo Europe, Essen, Germany	https://eu.extrusion-expo.com
	8-11 June	Argenplas, Buenos Aires, Argentina	www.argenplas.com.ar
	21-25 September	Colombiaplast, Bogota, Colombia	www.colombiaplast.org
	29 Sept-1 Oct	Interplas, Birmingham, UK	www.interplasuk.com
	13-17 October	Fakuma, Friedrichshafen, Germany	www.fakuma-messe.de
	4-5 November	Plastics Extrusion World Expo USA, Cleveland, USA	www.extrusion-expo.com/na/
2021	**4-7 May**	Plast 2021, Milan, Italy	www.plastonline.org/en
	17-21 May	NPE 2021	www.npe.org

AMI CONFERENCES

4-5 December 2019	Oil & Gas Non-Metallics, London, UK
24-25 March 2020	PVC Formulation, Cleveland, USA
28-29 April 2020	Plastic Pipes in Infrastructure, Hamburg Germany
2-3 June 2020	Profiles, Cleveland, USA
2-3 June 2020	Oil & Gas Polymer Engineering, Houston, USA
17-18 June 2020	Medical Tubing, Berlin, Germany
4-5 November 2020	Wood-Plastic Composites, Vienna, Austria

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

www.ami.international

PLASTICS RECYCLING WORLD EXPO

POLYMER TESTING WORLD EXPO

PLASTICS EXTRUSION WORLD EXPO

COMPOUNDING WORLD EXPO

3 - 4 June, 2020
ESSEN, GERMANY

4 - 5 November, 2020
CLEVELAND, OHIO

www.ami.international/exhibitions

Plastic Pipes in Infrastructure

2020

Trends in the design, production, installation and exploitation of plastic pipes systems

28-29 April 2020
Hamburg Marriott Hotel, Hamburg, Germany

Media supporters:

EUROPEAN POLYURETHANE JOURNAL

Pipe and Profile EXTRUSION

Plastic Pipes in Infrastructure

2020

The global use of plastic pipes in infrastructure development is on the rise, replacing those more traditional materials. Safety, cost effectiveness and sustainability are some of the main reasons why they are gaining such credibility. The eighth edition of AMI's international Plastic Pipes in Infrastructure conference will focus on plastic pipe systems used in drinking water supply & distribution, gas transmission & distribution, underground drainage & sewerage, and district heating.

The two-day technical conference programme features presentations from leading industry professionals exploring a wide range of topics from progressions in manufacturing and materials (including recyclate materials), innovations and developments in plastic pipe systems, joints and weldings with case studies provided throughout the agenda to offer learning from real-life experiences.

Plastic Pipes in Infrastructure 2020 will bring together attendees representing the entire industry, including pipe specifiers, installers, end users, resin suppliers, additive producers, machinery makers, pipe manufacturers, fittings suppliers, testing and certification bodies, etc.

The event will be a unique opportunity to hear from industry experts on their experiences, lessons and suggestions to make your pipeline infrastructure more efficient and durable.

> ***Great conference, interesting speakers, good networking opportunity!***
>
> André Nijland,
> Wavin Technology & Innovation

Five good reasons to attend:

- **Learn about new technologies and what they offer to plastic pipe systems**
- **Listen to leading pipe companies providing case examples of their successful projects**
- **Hear market trends and learn about the industry outlook**
- **Browse the exhibition and find out what companies are developing and what they can offer you**
- **Network with the supply chain**

Ways to get involved:

ATTEND

Register before 31st January 2020 and pay €1,040* saving €200 on the full price of €1240*. There are additional discounts for group bookings. The registration fee includes attendance at all conference sessions, the Networking Cocktail Reception, lunch and refreshment breaks on both days and a set of conference proceedings.

SPONSOR

A variety of sponsorship opportunities are available at this conference to help promote your company's products and services to this highly targeted international audience. Contact the Conference Hotline for further information.

EXHIBIT

Make it easy to engage with the audience at this busy event with your own highly visible exhibition space. Bring your own display stand and / or banners and use the space to showcase your company's products and services and make a lasting impact. The exhibition runs throughout the conference by the main meeting room and is host to the networking functions.

Space is limited so to avoid disappointment please register for this service as soon as possible.

*VAT may apply

CONFERENCE HOTLINE

Contact: Nicola Charlesworth, Conference Team Manager
Tel: +44 (0) 117 314 8111
Email: nicola.charlesworth@ami.international

SAVE €200
Register before 31st January 2020

Plastic Pipes in Infrastructure

2020

Tuesday 28th April 2020

08:30 Registration and welcome coffee
09:30 Opening announcements

SESSION 1 – CHALLENGES AND SOLUTIONS FOR THE PLASTIC PIPE INDUSTRY

09:40 **The daily challenges of utility companies - what can we expect in the future**
Speaker to be confirmed

10:10 **Conformity assessment of hygiene requirements for plastic products in contact with drinking water – new legal hygienic requirements in Germany**
Mr. Anton Wohlgemuth, Certification Engineer Business Unit Products,
DVGW CERT GmbH, Germany

10:40 **Challenges in marking on pipes**
Mr. Johannes Maier, Technical Sales Support,
WIEDENBACH APPARATEBAU GmbH, DEPARTMENT - DOMINO INDUSTRIAL, Germany

11:10 Coffee break

SESSION 2 – PROGRESSIONS IN MANUFACTURING, MATERIALS AND INSTALLATION

11:50 **GRP, HDPE and super duplex SS pipes in desalination projects from the technical and economical point of view**
Speaker to be confirmed

12:20 **PVC-O pipe and fittings case study: irrigation transformation project of sector XXII of the Payuelos Subzone in Leon, Spain**
Mr. Jose Angel Galera, Product Manager,
MOLECOR, Spain

12.50 **Progress in inline plastic pipe measurements – radar technology comes to plastic extrusion**
Dr. Jan Petermann, Product Manager Radar & Terahertz,
iNOEX GmbH, Germany

13.20 Lunch

14:50 **Development of a PE100-RC grade with a high level of disinfectant resistance**
Mr. Andrew Wedgner, PE Pipe Marketing Manager,
LYONDELLBASELL (BASELL SALES AND MARKETING BV), Netherlands

15:20 **Solutions for superior root intrusion resistance**
Mr. Gianpaolo Contarini, Area Manager (Technical Engineer and Salesman),
IPM S.r.l., Italy

15.50 **Cost advantages in the trenchless installation of PE pipes compared to open trench installations**
Mr. Ralf Glanert, Technical Account Manager for Infra and Rehabilitation,
WAVIN GmbH, Germany

16.20 Coffee break

17:00 **Moving towards smart pipe extrusion**
Dr. Henning Stieglitz, Managing Director, CTO,
BC EXTRUSION HOLDING GmbH, Germany

17:30 **Quality in extrusion lines – turning savings into profit**
Mr. Roberto Seghezzi, Sales Area Manager,
TECNOMATIC S.r.l., Italy

18.00 **Effect of recyclates on SCG resistance of HDPE pressure pipes**
Mr. Ernst van der Stok, Consultant Materials,
KIWA TECHNOLOGY, Netherlands

18.30 Networking Cocktail Reception

Wednesday 29th April 2020

09:00 Welcome coffee
09:30 Opening announcements

SESSION 3 – THE INDUSTRY IN ACTION, INNOVATIONS AND DEVELOPMENTS

09:40 **Advances in low temperature district heating**
Mr. Klaus Grønnegaard Lauridsen, Product Manager,
LOGSTOR A/S, Denmark, and
Mr. Alex Stolarz, Development Engineer Pipe Applications,
DOW EUROPE GmbH, Switzerland

10.10 **Welded PE100 sewer pipes up to ID 3500 for underground railway station in Stuttgart with difficult laying conditions**
Mr. Matthias Haese, Sales Director,
FRANK GmbH, Germany

10:40 Coffee break

11:20 **Benefits of PB-1 for pressure piping systems - What does a higher SDR class mean in practice for District Heating?**
Mr. Patrick Spijkers, General Manager,
THERMAFLEX ISOLATIE BV, Netherlands

11:50 **Full length tensile test**
Ms. Johanna Josefsson, Researcher, Polymeric Materials in Corrosive Environments,
RISE RESEARCH INSTITUTES OF SWEDEN, DIVISION MATERIALS AND PRODUCTION – RISE KIMAB, Sweden

SESSION 4 – JOINTS AND FITTINGS: THE WEAKEST LINK

12:20 **New joint restraint to connect PVC and PE pipe for both, low- and high-pressure applications**
Mr. Jim Jones, Director of Business Development,
GEORG FISCHER, United States

12.50 Lunch

14:20 **Long-term durability of new polymer composite pipes: a joint study with Aliaxis R&D and SUEZ Water France**
Dr. Jennifer Ravereau, Materials Engineer,
SUEZ GROUPE - CIRSEE, France

14:50 **Restrained mechanical devices performance and life characteristics, a test protocol**
Mr. Mike Griffin, Director of Engineering,
VICTAULIC, United States

15:20 Coffee break and conference ends

AMI reserves the right to alter the programme without notice.
The latest programme, including any new speakers, changes to the schedule, and any amendments to pricing and terms and conditions can be viewed on our website: ***www.ami.international***

BOOKING FORM

Book online

PLEASE COMPLETE IN BLOCK CAPITALS

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Invoice address *(if different from above)*: _____
_____

DELEGATE/EXHIBITOR DETAILS

Title: Mr/Mrs/Dr/Other: _____
First name: _____
Surname: _____
Position: _____
Email: _____
Special dietary requirements: _____
Signature: _____ Date: _____

Please confirm that you agree to your name being published alongside your company name and job title on the delegate list.
❑ *Yes* ❑ *No*

By booking for this event (please tick these boxes);

❑ *I agree to AMI's Privacy Policy (www.ami.international/about/legal)*
❑ *I agree to AMI's Terms & Conditions (www.ami.international/about/tac)*

PARTICIPATION

	Price	VAT	Total
❑ Early Bird Delegate Fee[1]: (until 31st January 2020)	€1,040.00	19%	€1,237.60
❑ Delegate Fee[1]: (from 1st February 2020)	€1,240.00	19%	€1,475.60
❑ Exhibition Space: (UK Companies)[3]	€1,825.00	20%	€2,190.00
❑ Exhibition Space: (Non-UK Companies)[4]	€1,825.00	0%	€1,825.00

Total: _____

[1] Subject to German VAT at 19% [2] Reverse Charge. [3] Subject to UK VAT at 20%. [4] Reverse Charge for companies from other EU countries, 0% for Non-EU companies.

METHOD OF PAYMENT

You will be sent an invoice in 7-14 working days.

❑ ***Pay by Credit Card by book online:***
We accept: Visa / Mastercard
Alternatively, please provide your contact details and we will send you a link to a secure payment gateway via email.
Name: _____
Email: _____

❑ ***Bank transfer quoting:*** 'Your invoice and A/C no.'
To: National Westminster Bank Plc.
Thornbury Branch, 16 the Plain, Thornbury, Bristol, BS99 5HD
Account number: **06814077** Bank no. **556138**
IBAN: **GB63 NWBK 6072 0306 8140 77** SWIFT: **NWBKGB2L**

PLASTIC PIPES IN INFRASTRUCTURE 2020 CONFERENCE INFORMATION

28-29 April 2020
Hamburg Marriott Hotel
ABC-Strasse 52
20354 Hamburg
Germany

Tel: +49 (0)40 35 05-0
Fax: +49 (0)40 35 05 1777

HOTEL ACCOMODATION

Delegates are responsible for booking their own accommodation. We have negotiated a room rate of €165 for a single room and €185 for a double (tax, breakfast and Wi-Fi included) at the Hamburg Marriott Hotel in Hamburg until 2nd March 2020.

Please make your reservation using the direct hyperlink which can be found on our website www.ami.international/events (click on 'Plastic Pipes in Infrastructure 2020' followed by Accommodation)

PARTICIPATION OPPORTUNITIES

Delegate booking: includes attendance at all conference sessions, a set of conference proceedings, entrance into the Networking Cocktail Reception, lunch and coffee breaks.

Sponsor this event: maximise your company profile before, during and after the event by becoming a sponsor. For further information, please contact the Conference Organiser.

Exhibition space: an excellent way to enhance your business opportunities and make it easy for delegates to find you! Includes:

- entry for one representative from your company
- one exhibition space in the networking area
- your company profile in the conference pack
- new and existing product display
- handing out brochures and promotional items from your stand

Spaces are allocated on a first-come-first-served basis and sell quickly.

Group discounts: when booking as a group you may be entitled to discounts. Contact the Conference Organiser for more information.

Networking Cocktail Reception

A networking cocktail reception will be held on the first evening. This offers an excellent opportunity for delegates to meet with speakers and other colleagues. All delegates are invited to attend and admission is included in the delegate fee.

CANCELLATIONS

Full refunds, less a cancellation charge of €300 will be made on cancellations received prior to 28th February 2020. Thereafter we regret that no refunds can be made. Delegates may be substituted at any time. Please note that refunds will not be given on exhibition spaces, sponsorship packages or networking dinner places.

CONTACT US

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The latest programme, including any new speakers, changes to the schedule, and any amendments to pricing and terms and conditions can be viewed on our website: www.ami.international