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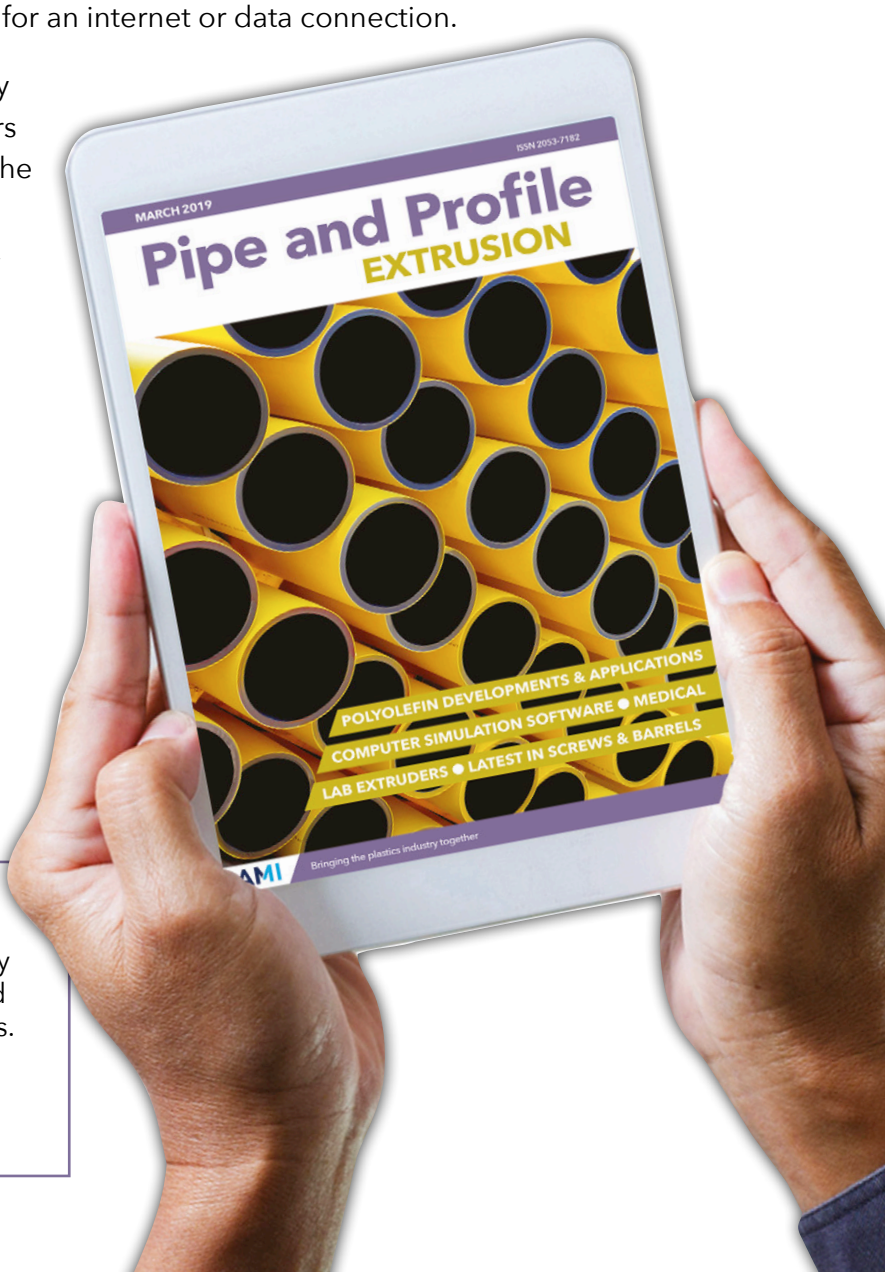
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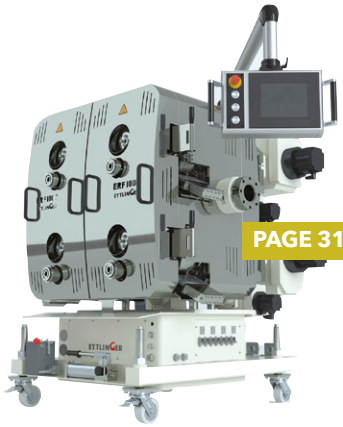
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Poor weather and delays affect revenues at Polypipe

UK-based pipe manufacturer Polypipe has reported a "resilient performance" in the first 10 months of 2019.

However, it expects full-year profits to be "below its previous expectation".

In a trading update, the company said that revenue is slightly ahead on a year-on-year basis. For the period, sales exceeded £391 million (US$505m), which was 4% higher than the same period in 2018.

In the four months since its interim results, the company raised sales by nearly 2%. This was dragged down by flooding in the UK, which meant that contractors and developers were not able to access sites for civil and groundwork activities.

In the four months since its interim results, sales from the residential systems business rose by nearly 8% – due in part to a healthy performance by the recently acquired Manthorpe Building Products. Over 10 months, sales were also up by 8%.

Sales in commercial and infrastructure systems segment fell by nearly 6% in the same period. This was caused by tougher trading conditions, caused by increased project delays in the UK commercial construction sector. On a 10-month basis, sales declined very slightly.

"Despite challenging market conditions and severe weather, we still expect to report good growth in profits, albeit just below our previous expectations," said Martin Payne, CEO of Polypipe.

› **www.polypipe.com**

Isco expands gas distribution

US-based HDPE pipe distributor Isco has bought its smaller rival, MT Deason.

Isco says this will allow it to increase surface capacity in the gas distribution market. Deason will operate as a division of Isco, providing full-service offerings of pipe, fittings, fusion equipment, and valves.

"Deason has been a pioneer in electrofusion and gas pipe fittings and has an excellent reputation for providing quality products," said Jimmy Kirchdorfer, CEO of Isco.

Deason, founded in 1982, has locations in Alabama, Texas and New Jersey. Isco, headquartered in Louisville, Kentucky, was founded in 1962 and has more than 35 locations across North America.

› **www.isco-pipe.com**

Medical brands combined

Tekni-Plex is bringing all its medical brands – Colorite, Natvar and Dunn – into a single division called Tekni-Plex Medical.

The business will supply medical products, including specialist compounds and tubing, to medical device manufacturers from a single source.

Its sales team will represent all product lines.

Manufacturing will be done at the same locations, and the Colorite, Natvar and Dunn will continue be used as product brands, says the company.

Colorite includes PVC and TPE medical-grade compounds; Natvar is known for multi-layer and multi-lumen tubing, and other extruded products; and Dunn makes precision tubing for catheters and minimally invasive devices, and other products.

› **www.tekni-plex.com**

PA12 pipe for gas installation project

US-based Teel Plastics has supplied hundreds of feet of polyamide 12 pipe for a gas installation project in Kentucky.

The installation of 2,800 feet of pipe, is the first phase of a multi-stage project to run gas pipe through the centre of Henderson, Kentucky. It is installed via horizontal directional drilling (HDD). The initial installation took three days.

McElroy, which supplied the joining equipment for the project, said it was the first example of PA12 pipe being installed under new rules – which should open up the market to wider use of PA12 pipe.

It added that the process of fusing PA pipe is similar to that of fusing PE pipe – and far easier than welding steel pipe.

For more information on the use of engineering thermoplastics in pipe, see our **feature** starting on page 25.

› **www.teel.com** › **www.mcelroy.com**



Expanded plastics exhibitions return to Cleveland in 2020

Three free-to-attend exhibitions – on extrusion, compounding and plastics recycling – will return to the Huntington Convention Center in Cleveland, Ohio, USA on 4-5 November 2020. They will be joined by a new event on polymer testing and analysis.

The Plastics Extrusion World Expo, Compounding World Expo and Plastics Recycling World Expo made their USA debuts in Cleveland in May 2019, attracting 261 exhibitors and 4,375 visitors.

This year they will be joined by the Polymer Testing World Expo, a new focused exhibition and conference for scientists, laboratory staff and researchers who develop, test and analyse new polymer materials, formulations and products. It will benefit from the considerable crossover with the other exhibitions: last year, 1,091 of the visitors to the other three expos said they were involved in R&D and materials testing.



Last year's debut event was well attended and featured a number of machinery demonstrations

The exhibitions will see the return of five free conference theatres. These proved very popular in 2019, attracting large crowds for a series of technical papers, market forecasts, training seminars, and business debates.

"We were delighted with the response to our first US exhibitions, which were very well supported by the North American plastics extrusion, recycling and compounding industries," said AMI's head of exhibitions, Rita Andrews. "We've had extremely positive feedback about the Cleveland shows from exhibitors and visitors alike."

More than 200 companies have already booked their booths for the four focused expos in Cleveland in 2020. They include Amut, Atlas, BYK, Clariant, Coperion, Cumberland, Davis Standard, Dover Chemical, Entek, Erema, Farrel Pomini, Gneuss, Heritage Plastics, Konica Minolta, KraussMaffei Extrusion, Leistritz, Maag, Maguire, Matsui, Milliken, Netzsch, NFM, NGR, Nordson, Omya, Piovan, PolyOne, PTi, Q-Lab, Reifenhauser, Struktol, Thermo Fisher, Vecoplan, Wacker, Windmöller & Hölscher and Zoltek.

Booths at the exhibitions start at less than $4,000. For more information, download the brochure **here**, or contact AMI's exhibition team at **exhibition_sales@ami.international**.

New head at PPI

The Plastics Pipe Institute (PPI) has named David Fink as its new president.

He was previously senior vice president at WL Plastics.

Prior to this he worked in the polyolefin resin business at Dow Chemical – with the majority of his time spent in the pipe resin business.

Fink was also chairman of the PPI board of directors from 2017 to 2019.

› **www.plasticpipe.org**

Danfoss to buy Eaton hydraulics business in US$3.3 billion deal

Danfoss of Denmark is to acquire the hydraulics business of US-based Eaton.

The deal, worth US$3.3 billion, is expected to close by the end of this year.

The acquisition will see Danfoss acquire the majority of Eaton's hydraulics division – including its interests in hosing and tubing.

Eaton will retain only the filtration and golf grip parts of the segment.

The business it will sell to Danfoss earned US$2.2bn in 2019, and employs around 11,000 people.

"This is a once-in-a-lifetime opportunity to combine our largely complementary portfolios and geographic footprints," said Kim Fausing, president and CEO of Danfoss. "With this agreement, we continue to invest in our core hydraulics business and digital solutions to stay a strong technology partner."

The business will be transferred into Danfoss' power solutions segment. The acquisition will double Danfoss' hydraulics business – and increase the company's overall size by one-third.

"Eaton's hydraulics team will be part of a company that is committed to becoming a global leader in mobile and industrial hydraulics," said Craig Arnold, chairman and CEO of Eaton.

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Free registration opens for industry expos in Germany

Free online **registration** has opened for four exhibitions focused on plastics extrusion, recycling compounding and testing.

Organised by AMI, the Compounding World Expo, Plastics Extrusion World Expo, Plastics Recycling World Expo and Polymer Testing World Expo will take place at Messe Essen in Germany on 3-4 June 2020.

By registering in advance, visitors will receive free admission to all four exhibitions, featuring more than 300 international suppliers, plus free entry to five focused conference theatres hosting technical presentations, educational seminars and debates.

"The event will provide visitors with a great opportunity to meet and compare suppliers from around the world, as well as giving them the chance to learn from business leaders and technical experts in the conference sessions," said Rita Andrews, head of exhibitions at AMI.

The expos will feature a wide array of leading manufacturers of extrusion, compounding, recycling, testing and analysis equipment, plus suppliers of a huge variety of polymers, additives and related services.

The conference theatres will feature more than 100 expert speakers over the two days, including influential representatives from leading compounders, extruders and recyclers, plus exclusive market presentations from AMI's consultants and editors.

"Our debut compounding and recycling exhibitions in Essen, Germany attracted 184 exhibitors and 4,024 visitors in 2018," said Andy Beevers, AMI's events director. "We are confident that our next Essen event in 2020 will build on this success with the addition of two new focused exhibitions and many more exhibitors."

The exhibitor line-up already includes a large range of international companies such as Azo, BASF, Biesterfeld, Borealis, Bühler, Buss, Cabot, Clariant, Coperion, Dynisco, Erema, Evonik, ExxonMobil, Farrel Pomini, Fraunhofer, Frontier Lab, Gabriel Chemie, Gneuss, IMCD, JSW, Konica Minolta, KraussMaffei Extrusion, Maag, Mixaco, Mitsui, Montello, Motan Colortronic, NGR, Nordson, Norner, Omya, Solvay, Starlinger, Veolia and over 200 additional leading suppliers.



The debut expo event, which was held in Essen in Germany last year, attracted a wide variety of visitors and exhibitors

The limited number of remaining booths are being filled on a daily basis. To find out more about exhibiting at any of the expos, visit **https://www.ami.international/exhibitions**.

Essen is readily accessible by car and public transport from major industrial hubs in Germany, Benelux, France and beyond. In addition, it is just 20 minutes' drive from Düsseldorf airport. Making the same journey by S-bahn and U-bahn trains takes under 60 minutes.

To book your free ticket, which is valid for both days of the event, visit: **www.ami.ltd/Register-AMI-Expos**

India's Polyhose invests in USA operation

Polyhose, an Indian manufacturer of industrial hoses, is to build a plant and warehouse in North Carolina, USA.

A US$7.9 million investment will be used to build a 40,000 square-foot assembly plant and warehouse. The company plans to hire 51 new employees.

Polyhose makes thermoplastic, hydraulic, PTFE and industrial hoses and tubing for clients including Caterpillar and Boeing. It employs more than 1,800 people across Europe, the Middle East, Asia and North America.

"We are thrilled to be making our first significant USA investment," said Jonathan Pressler, senior vice president at Polyhose Inc.

A performance-based grant of US$75,000 from the One North Carolina Fund will help facilitate Polyhose's operation. The fund provides financial assistance to local governments to help attract economic investment and create jobs.

Companies receive no money upfront, and must meet job creation and capital investment targets to qualify for payment.

One NC grants require a matching grant from local governments.

› **www.polyhose.com**

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Poor year for Italian machinery for first three quarters of 2019

Trade data for the first three quarters of 2019, generated by the Italian National Statistical Institute and analysed by the sector trade association Amaplast, indicates a negative year-end result for the Italian plastics and rubber processing machinery industry.

Amaplast attributes the poor result to "many issues and unknowns characterising the current world economic climate, compounded by the announced, but as yet poorly defined, legislative and fiscal measures aiming at reducing the use of plastics".

Italian market for plastics and rubber machinery, equipment and moulds (Forecast Δ% 2019/2018)

Production	-9
Exports	-8
Imports	-15
Domestic market	-12
Trade balance	-5

Source: Amaplast

Both exports and imports were down on the same period in 2018. The former fell by 8.5% to €2.16bn; the latter 13.1% down to €645m. The trade balance fell by 6% but remains positive at €1.5bn, according to the association.

"I note a certain amount of concern deriving from the less than encouraging prospects for both the domestic and foreign markets," said Amaplast president Dario Previero. "However, we must not overlook the fact that this slump – whose first signs were seen in the year-end results for 2018 – comes after a long period of growth."

Germany remains the top export market, though sales there were 19.9% down at €270m and its share of the total fell from 14.3% to 12.5%. Most other European export markets were also weak. However, Italy's second biggest market, the US, bucked the trend with sales 15.0% up to €224m, taking its share of the total to 10.4%.

Some of the sharpest declines were in Turkey (-30%), Austria (-28%) and Switzerland (-24%). South Korea also saw a decline (-31%). However, positive growth was seen in other Asian markets, notably Thailand (+24%), Indonesia (+39%), China (+14%) and Japan (+33%).

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Making mixing more effective

The latest ideas in mixing technology were on show at K2019. Peter Mapleston takes a look at some of the innovations

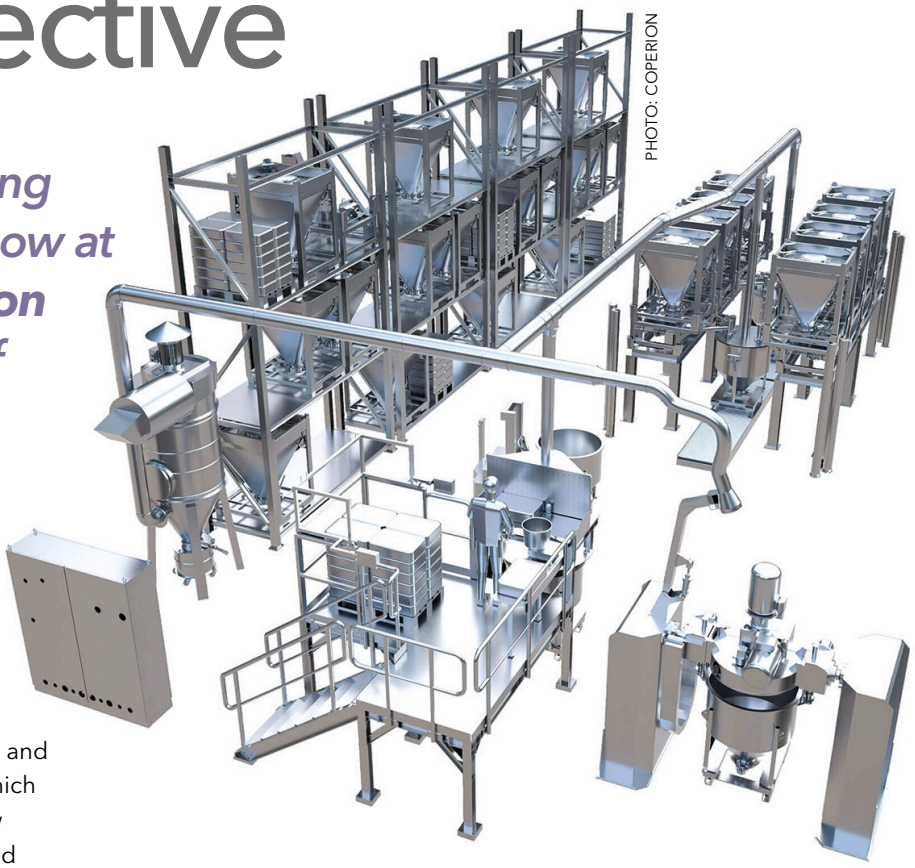


PHOTO: COPERION

Mixing technologies are well-established, though stepwise improvements – and some leaps forward – continue to be made. The latest offerings were on display at the K2019 exhibition in Germany recently.

Automation of multi-ingredient handling and mixing was on the agenda for Coperion, which used the show as the launch pad for its new Add-A-Lot system. It enables fully automated recipe preparation that Coperion says fulfils high demands for constant product quality, seamless documentation, and batch traceability.

"Particularly as production trends toward shrinking batch sizes, frequent product changes, and the multitudes of formulations and components associated with them, such automation provides a high degree of safety to the users," the company says.

At the heart of the Add-A-Lot system is a feeding station with standardised storage containers (IBCs), feeding unit, and mobile mixing containers. Transport of centrally stored components is fully controlled, as is precision feeding and mixing of additives, even in very small quantities.

IBCs docked on the upper level of the feeding station are opened automatically. Feed screws then convey materials to the mixing container in accordance with the recipe. As many as eight feed screws can deliver to a single weighing scale. To prevent cross contamination between recipes, feed screws can be easily removed and replaced. IBCs and mixing containers can be either manually or automatically transported using an automated guided vehicle (AGV) or roller conveyors.

Flexible optimisation

The Add-A-Lot system is modular, so can be configured to specific customer needs. For example, surge bins (which can be furnished with discharge aids such as pneumatic knockers, agitators, or vibrators) can be modified for incoming packages of various products. And by using a base frame, it is possible to place big bags directly on the feeding station.

The Add-A-Lot feed system's controls are integrated into Coperion's own control systems, enabling recipe management, production planning and storage administration as well as batch tracing and documentation using barcodes, RFID, or other technologies. Customers can choose what brand of container mixer to use in the system.

Main image: Automation of the mixing process is a common theme that runs from small batch equipment to huge installations such as Coperion's Add-a-Lot

Natural solutions

On a smaller grand scale, a highlight from the **MTI Mischtechnik** display was a Flex-line heating/cooling mixer combination which, together with a Vent tec 2.0 aspiration system, was optimised for the production of dry blends for natural fibre-reinforced compounds (NFCs).

Also designed on a modular basis, Flex-line

mixers can normally be used for a wide range of applications; mixer sizes, drives and equipment options can all be individually configured. The M 1000/K 3300 version on the company stand used a heating mixer volume of 1,101 litres and a cooling mixer volume of 3,308 litres, for typical batch sizes of 400 kg and an output of over 1,600 kg/h. The unit was one of a series of machines ordered by an Asian NFC-processing company.

High aspiration

The performance of the aspiration system is matched to the application. "Unlike conventional solutions, these devices control their operation autonomously as a function of actual process parameters, thereby providing constant processing conditions irrespective of changes in process and ambient conditions," says MTI. "They achieve this by continuously monitoring all actual operating conditions via key parameters such as intake air and system air temperatures, air pressure, humidity and, with high significance, the aspiration air flow rate."

MTI says that, even under unfavourable conditions when processing natural fibres with fluctuating but relatively high moisture contents, efficient dehumidification of the blend is ensured. Preparation times, depending on the raw material moisture content, are usually less than 15 minutes, it claims.

Applications of such mixer-aspiration combinations also include the production of almost completely dehumidified rigid and soft PVC dry blends. Especially with PVC formulations containing hygroscopic stabiliser systems, they prevent the formation of deposits on the interior surfaces of mixers and downstream equipment.

Below: The Flex-line heating/ cooling mixer can be paired with a Vent tec 2.0 aspiration system for mixing natural fibre reinforced compounds

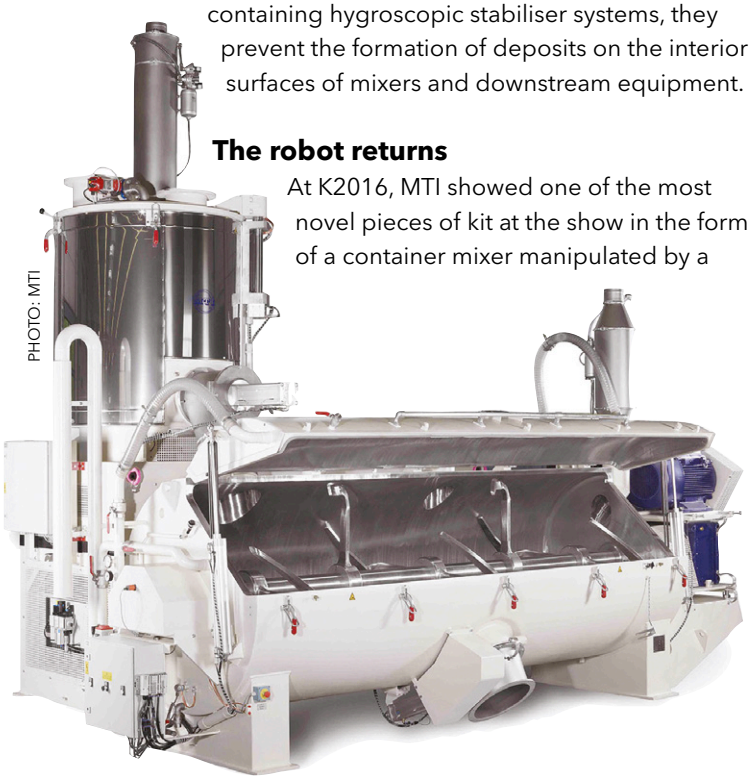


PHOTO: MTI

The robot returns

At K2016, MTI showed one of the most novel pieces of kit at the show in the form of a container mixer manipulated by a giant six-axis robot—the C tec PRO. Three years on and company CEO Christian Honemeyer says MTI expects very soon to sign a major contract with an unnamed company that has been using the system for several months for production of pigmented polyethylene. "The system is now fully proven," he says. "We have shown that it can produce up to 10 batches an hour, between 100 and 750 litres each."

The C tec PRO system now has a CE certification and is ready for operating on a 24/7 basis over the course of a contract (MTI will lease the system) of 36 months. Over the past three years, it has undergone various minor modifications, Honemeyer says, mostly to the mixing head.

Clean savings

Time taken to clean equipment is unproductive time. And, because of the nature of the batch mixing process, cleaning is an important element in the daily routine. "Especially with small batches, the availability of a mixer decreases," says Karl Hendrik Schluckebier, Sales and Process Manager for the Mixing business unit at **Zeppelin Systems**, which owns the Henschel brand. "By selecting the right mixer types, cleaning time and thus production costs can be saved."

He also notes that the use of cleaning agents and the disposal of drag losses are important criteria for investments in new mixing plants.

Schluckebier says that in the development of Zeppelin's new Henschel-Mixer CMQ container mixer, the focus was on not only the quality of mixing and dispersing but also on cleaning aspects.

"Critical components were specifically optimised for this purpose," he says.

There are already various solutions on the market for automatic cleaning of the container and, since multiple containers can be used with a single mix head, this operation can be done offline without affecting productivity. But if a recipe change is required, Schluckebier says, the parts of the mixer that come into contact with the product have to be thoroughly cleaned. Contamination on the surrounding periphery must be completely removed too.

"In order to ease the cleaning of the mixing tool, the tool should be easy to dismantle and free of sharp edges and shadows. In addition, the pressure on the wall and bottom created during mixing should be kept to a minimum so that there are no deposits in the mixer and there is no high increase in the material temperature," he says.

Mixers are often equipped with slow-running tools that may work in combination with one or

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more high-speed dispersion tools. "In view of the cleaning aspect, the aim was to combine moving and dispersing in one tool," says Schluckebier. "With the usual tools, the bottom clearance must be kept very small so that the material circulates evenly in the mixer in the form of a vortex. A large distance means that the material is no longer lifted sufficiently, resulting in an uneven distribution. Although a higher peripheral speed counteracts this, the result is a higher rise in temperature and deposits on the tool and mixing head."

Wing section

The answer to this quandary came with the development of a new tool with a wing-like cross-section. The mixing arm, which has "winglets" similar to those often used on commercial airplanes to reduce air resistance, produces a very low mixing resistance.

"This reduced energy input limits the temperature rise to less than 2°C/min," claims Schluckebier. It also allows a higher tool speed (up to 20 m/s), which in turn increases dispersion.

The high lift force created by the geometry of the wing allows a very large bottom clearance (up to 70mm), which facilitates cleaning between the tool and mixing head. In addition, the shape and the polished surface of the mixing tool prevent deposits and, on top of this, the mixing tool is light in weight (around 15 kg for a 1,000-litre mixer), so it can be dismantled very quickly for cleaning or replacement by another pre-cleaned tool.

A further benefit of the high lift force is in the seal area. Most mixing heads are trough-shaped, with a seal around the rim where deposits can accumulate. Schluckebier says that the high lifting forces on the CMQ make it possible to use a much easier-to-clean flat plate instead. "This combination achieves at least equivalent results compared to other container mixers equipped with homogenising and dispersing tools," he says.

Plant cleanliness

Container mixers are usually moved under the mixing head on a guide system in the floor. When the container is moved away at the end of the mixing process, some material almost always falls off the mixing head and mixing tool onto the rails. Schluckebier says the design of the CMQ container holder and clamping rotary holders makes it possible for the container to be centred with no need for rails, making floor cleaning much easier. Combined with the other system features, cleaning times can be cut down to no more than 15 minutes, he says, compared with anywhere from 40 minutes up to two hours.

Hot over cold

Cleaning takes much longer with hot mixing than with cold mixing because the entire mixing container and the lid must be cleaned and the multi-component tool set and deflector (where used) must be removed in order to gain access to all corners and edges. Zeppelin has been making changes here, too, resulting in what Schluckebier says are significantly reduced cleaning times.



PHOTO: ZEPPELIN SYSTEMS

Right: Zeppelin's new container mixer works with a wing-profile tool mounted on a flat, polished plate

Removing the mixing tool from mixers with a fixed mixing bowl requires the operator to bend over the edge of the bowl, and maybe even to climb in. That takes time and calls for special safety measures. With the new design, the operator has full access to the inside of the tank, as it is in two parts allowing the upper part to be lifted from the bottom shell and swivelled to the side. "The new design reduces the cleaning time from 30 to 180 minutes to 5 to 20 minutes," says Schluckebier. "In productions where recipes are changed several times a day and cleaning is essential, high five-digit annual savings can be made."

Many other companies also exhibited their latest mixer offerings at K2019.

PlasMec showed its well-established Combi-



PHOTO: ZEPPELIN SYSTEMS

Left: The three-part design of Zeppelin's new high-speed mixer is said to ensure easy and quick cleaning

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Right and below: The Container Mixer i4 mixing head is easy to clean and accepts different container sizes



PHOTO: MIXACO

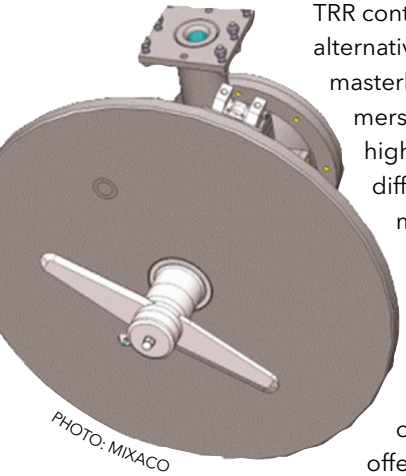


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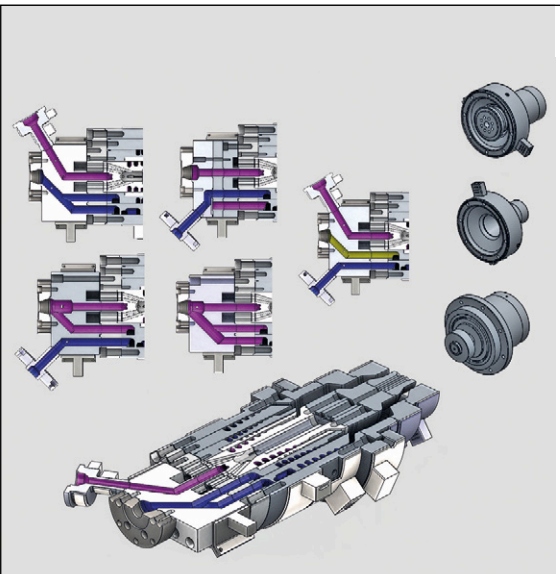
mix-HC-800/2500 mixing system, which it says incorporates the latest developments in terms of mixing safety. Also on the stand was a TRR-1500/FV container mixer configured in accordance with ATEX regulations to make it suitable for mixing powders with explosion potential.

The company says Combimix hot/cold mixers are the ideal solution for mixing dry PVC or WPC (wood/plastic composite) dry blends. Models are available over a wide size range. The TRR container mixer is described as an ideal alternative to turbomixers for the preparation of masterbatch, pigments and engineering polymers, when production conditions require a high degree of versatility and a wide range of different recipes to be mixed in the same machine.

Mixaco describes its Container Mixer i4 as the mixer concept for Industry 4.0 and the Internet of Things. Sales and Marketing Specialist Guido Brand says it is the latest progression of the company's original Vortex model. The company now offers these two units either side of the Multitool model, which introduced the concept of a single mixing head being used for many containers around six years ago.

Brand highlights high mixing flexibility, high quality and reduced required cleaning effort in the new design, which incorporates a new controller, the MCC (Mixaco Control Centre). The inside surface of the mixing head is completely flat, as the sealing gasket is now incorporated into the container. This makes it very easy to clean. It also enables it to be used with three different container sizes (300, 450 and 600 litre), which can all be designed in compliance with ATEX requirements. Dedusting equipment built into the head extracts fine dust generated in the container at the end of the mixing process. The head also contains a temperature sensor, with the temperature indicated on the operating panel.

Brand says the i4 mixing tool enables good mixing vortex formation, even with moderate circumferential speeds of 4-15m/s, which also helps to minimise temperature increases. The mixing equipment is controlled as standard with a Siemens S7 PLC, but users can also opt for Allen-Bradley components. It can also be equipped with an interface for data exchange with high-level control while a remote maintenance module allows troubleshooting by Mixaco service staff.



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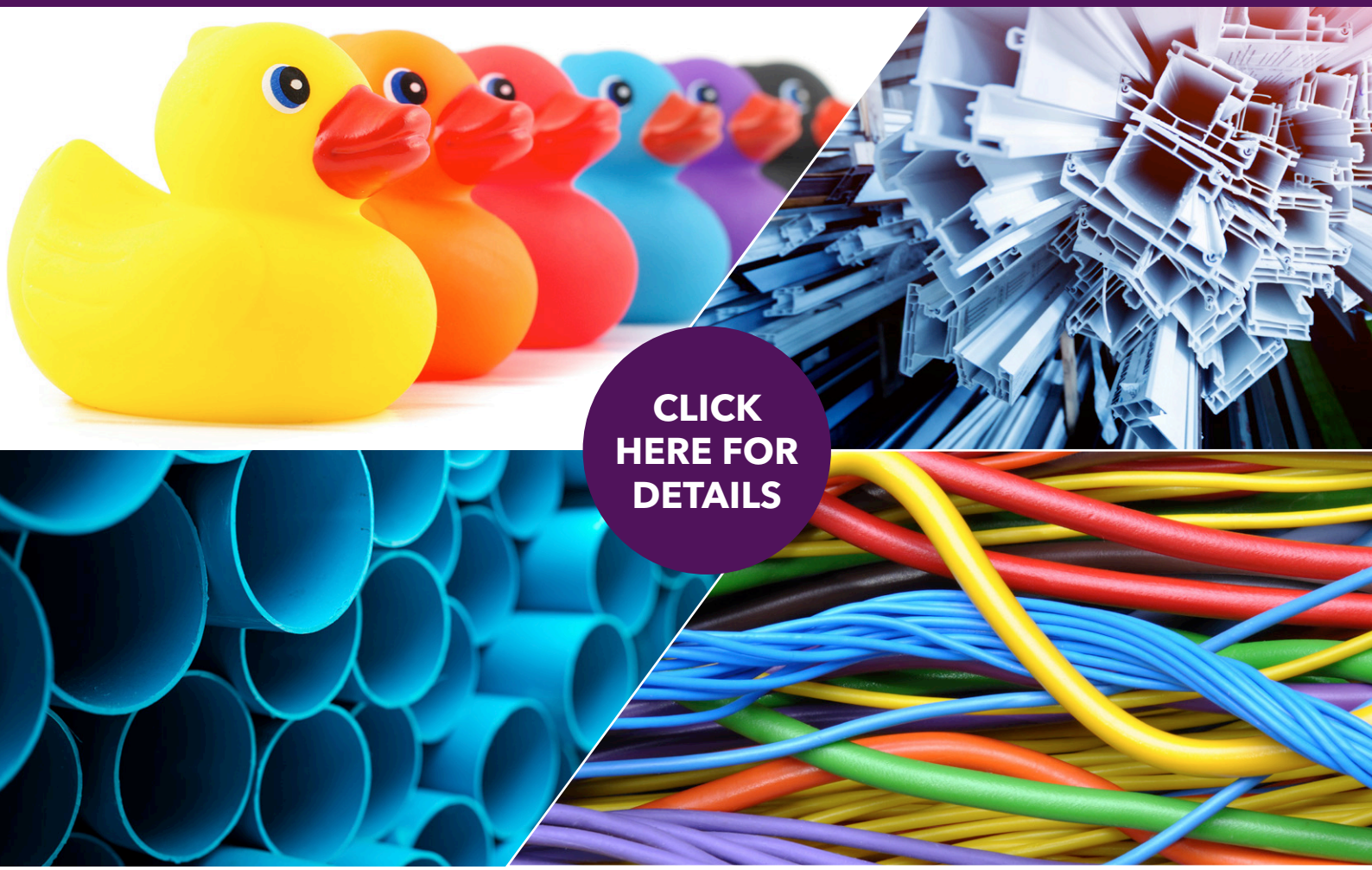
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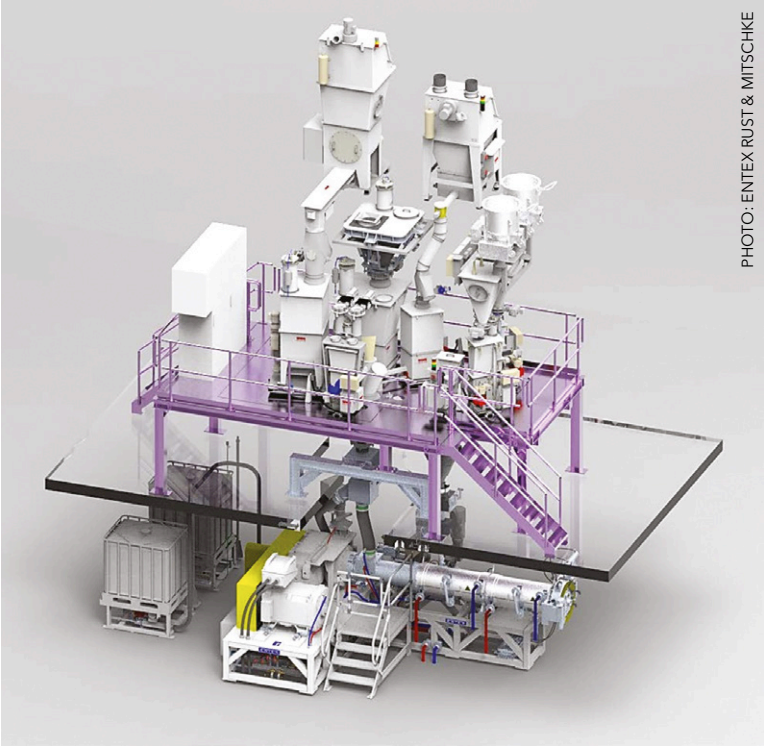


PHOTO: ENTEX RUST & MITSCHKE

Above: Entex sees its continuous PRE mixing system for PVC as an effective alternative to batch mixers in volume production

Powerful blending

Promixon was promoting its XM turbo mixer, which the company considers to be "one of our most innovative and powerful systems, capable of blending at any speed while maintaining a high level of performance and reducing usage problems." According to Promixon the XM turbo mixer "lasts longer, is more productive, and is less of a burden on finances."

The company says requirements from customers for faster intervention to tackle production problems, as well as calls for changes or upgrades on production automation of production, have reached very high levels in recent years. "The accurately-studied automation system provided on our machines, united with a remote connection, helps our customers to reduce risks of non-compliant material due to human error and drastic reduction of machine downtimes, with prompt intervention in very short time by our specialists," according to a company spokesperson.

Company president Marco Marinello also spoke of its successful bid for what he says was the biggest single mixing plant ever produced. The contract, for a US producer of luxury vinyl tiles, included an XBlend-MC/2500/8600 system comprising an XM-2500 high speed heating mixer and an XC-8600 horizontal cooler XC-8600. The unit was customised to variable filling level and to process a wide range of formulations, oriented to the reduction of mixing time and minimal energy consumption.

Marinello says that it has an output of 9,600kg/h, based on eight batches/h of dry blend. The cooler is engineered to receive up to 1,500 kg/batch of $CaCO_3$ filler.

Continuous options

Meanwhile, **Entex Rust & Mitschke** says its Planetary Roller Extruder (PRE) provides an interesting alternative to the traditional approach of making PVC compounds via discontinuous production of dry blends with hot and cold mixers. When used in a direct compounding configuration (see schematic) the continuously-running equipment has a higher investment cost, but as Thomas Birr, Head of Process Engineering at the company argues, this can be recovered by lower running cost (energy consumption is said to be much lower).

In the Entex solution, raw PVC is dosed into the PRE with the stabiliser system added in parallel as a separate component. Diffusion of the liquid components into the PVC, which normally takes place in the discontinuous process in an internal mixer, takes place mechanically in the PRE through a combination of friction and pressure as the liquid components are rolled over the solid PVC.

To some extent, the direct PVC compounding PRE mimics hot and cold mixing. The PRE comprises two modules: the raw material is melted, dispersed and homogenised in the first before passing directly to the second, where temperature and pressure are significantly lower.

Although this process is accompanied by some heating of the polymer, thermal damage is prevented by the short dwell time of the melt in the high temperature zone.

"Examinations of the extrudate have shown that the thermal damage of the polymer in direct extrusion is usually even lower than in the traditional dry blend method," claims Birr. Entex says that total residence times in hot and cold mixers are several minutes, while in direct compounding can be under one minute.

Entex has been proposing this mixing approach for some time, but Birr says interest has recently picked up, especially for greenfield operations. He estimates there are up to 20 PREs currently being used for PVC direct compounding around the world.

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Engineering a change

Composites and engineering plastics are often specified for extreme environments – ranging from offshore applications to car engines

Even the toughest plastics struggle to compete with the mechanical properties of steel – but their ability to resist corrosion, act as a barrier and combine with other polymers can make them the material of choice in a number of challenging environments.

One example in the offshore industry is that of Brazil's pre-salt region – an oil-rich reserve below both carbonate salt and water. It can use thermoplastic composite pipe (TCP), as long as the materials are correctly chosen.

Victrex, whose Peek material forms the basis of M-Pipe – a TCP from Magma Global – recently ran a seminar with Magma and TechnipFMC, to explain how to combine polymeric materials with traditional flexible pipe to create 'hybrid flexible pipes' (HFPs).

"In flexibles, the loading on the polymeric components is low as it acts as an intermediate leakproof sheath," said Geoff Small, head of technology for energy at Victrex. "In HFPs the role of the polymer is also to act as a protective liner/conduit – and most importantly as a matrix for the composite."

To overcome technical challenges and assess solutions for use in Brazil's pre-salt region, the composite materials selection needs thorough assessment, he said. The region contains large reserves of high-quality light oil – but high levels of CO_2 (around 12%), H2S – plus high temperatures and pressures – challenge the use of steel. The conditions mean that most conventional polymer/composite systems are at the limit of their performance.

An approach from Magma and Technip puts a conventional armour and sheath around a TCP to create the HFP. The idea is to extend strength to weight ratio, compared to a conventional flexible pipe.

The HFP uses a Peek-based carbon fibre composite that offers high temperature and chemical resistance – including low permeation and a barrier against corrosion. This is helped by the good bonding between Peek and the fibre, says Small.



Main image: Victrex Peek is used on Magma Global's M-Pipe TCP – and now on a new type of hybrid pipe

Sticking with polyamide

Kraiburg has developed a range of thermoplastics elastomers (TPEs) that can be co-extruded with polyamide (PA) to produce high-quality corrugated tubes.

In the first commercial application of the material, Schlemmer Group is producing new types of Polyflex corrugated tubes – for cable management systems in cars – by co-extruding PA with a Thermolast K AD/PA/CS2 compound.

Direct adhesion of a TPE to a polar plastic such as PA requires the two components to be carefully selected and matched. Kraiburg has studied these criteria and has developed a range of custom-engineered compounds. Typical multi-component applications of this type include injection-moulded gaskets, mounting elements, cable bushings and membranes.

The new types of Polyflex tubes have extended Schlemmer's requirements for TPE components. In order to avoid sharp edges – and allow faster installation thanks to slit corrugated tubes – the


IMAGE: SCHLEMMER

Right: A new type of Polyflex corrugated tube is co-extruded from polyamide and a TPE from Kraiburg

product developers' design was aimed at combining PA and TPE by co-extrusion.

After extensive testing, Schlemmer chose a TPE from the new AD/PA/CS2 Thermolast K series, which was developed for injection moulding and co-extrusion applications with polyamides such as PA6, PA66 and PA12.

The products are characterised by their adhesive properties, and they provide an outstanding compression set, says Kraiburg. While their maximum service temperature is 125°C (3,000 hours), they resist peak temperatures of up to 150°C for short periods (240 hours). They also feature high elongation at break, tear strength and resistance to tear propagation, as well as slow burning (UL94 HB). In addition, the TPE family provides a very aesthetic surface quality with excellent wear resistance that does not require finishing, at a hardness range between 40 and 80 Shore A. The selected compound shows a peeling resistance of more than 8.5N/mm during tests in accordance with the VDI 2019 standard.

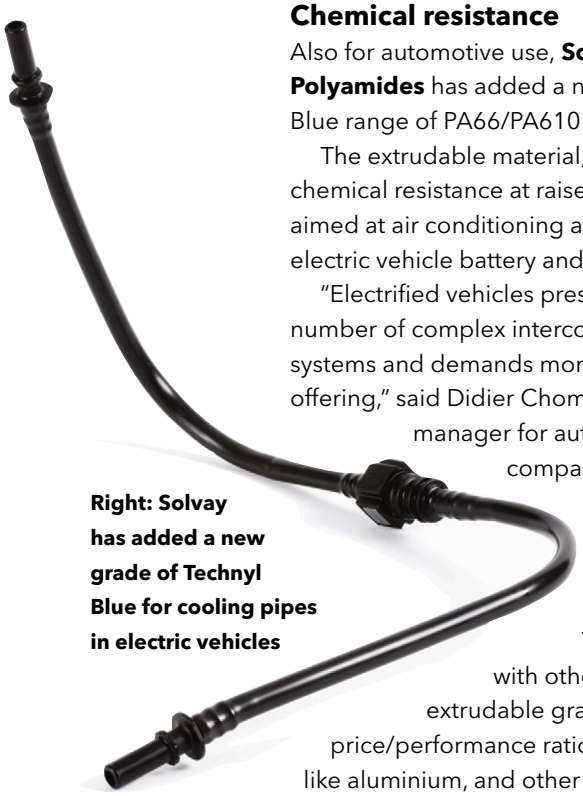
"We were looking for a TPE that provides the necessary heat resistance and cold toughness for use in motor vehicles, and can also be extruded economically with polyamide – without the use of bonding agents," said Michaela Zagler, material development specialist at Schlemmer. "It was also necessary to ensure reliable adhesive strength in this material composite."

Chemical resistance

Also for automotive use, **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."



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

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.

Conductive inner layer

At the same time, **Evonik** has developed a conductive, low-extractable multi-layer tubing system for 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. ›

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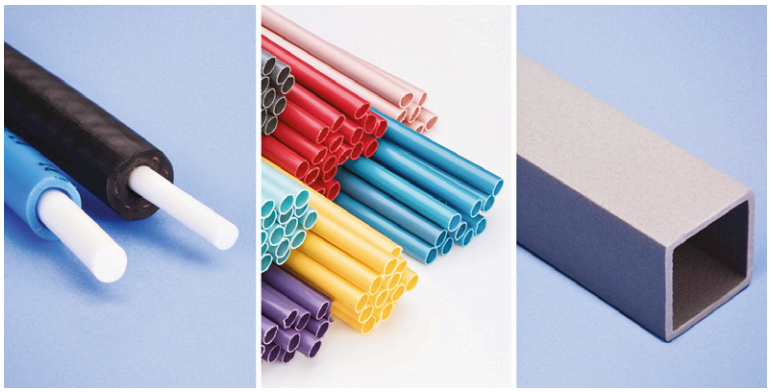
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Above: BASF's new Ultradur grade can be used for extruded products such as pipes and profiles

"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."

Extrudable PBT

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.

Alternative inserts

At the same time, BASF has developed a new grade of Ultradur – for co-extrusion with PVC – that has an improved property profile. The grade, B4040 G11 HMG HP green 75074, offers a lighter way of stiffening PVC window profiles, compared to steel inserts.

The material is an Ultradur blend that is reinforced with 55% glass fibres. Its melt temperature has been lowered, which simplifies the co-extrusion process – as its melting point is very close to the processing temperature of PVC.

"The grade offers profile manufacturers and window producers clear advantages in production," said Kay Brockmüller, project manager for construction at BASF. "Our product and the manufacturing process are amenable to trouble-free integration into existing production lines."

A co-extruded profile is weldable and can be machined on existing equipment. For window makers, this simplifies the production process by eliminating all steel-related activities. The lighter weight also makes handling easier – during both production and installation. A further positive feature for the customer, in addition to improved insulation performance, is that the profile exhibits high dimensional stability when installed and shows virtually no post-shrinkage after installation.

At the forthcoming Fensterbau Frontale exhibition, held in March in Germany, systems provider Profine will present a profile called ProStratoTec using this technology.



Right: This co-extruded profile, made from BASF's Ultradur (in green) and PVC, forms the basis of highly insulating windows

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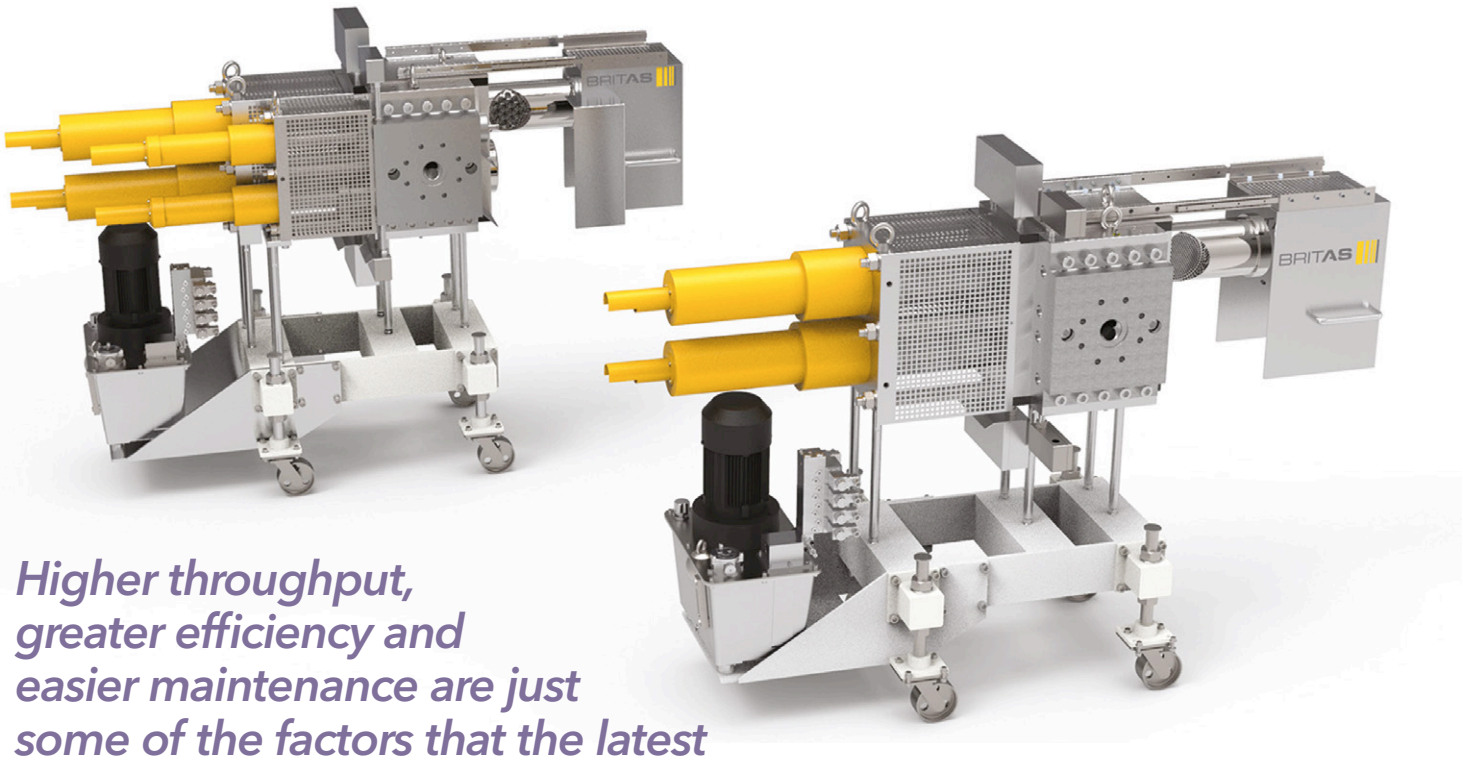
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Higher throughput, greater efficiency and easier maintenance are just some of the factors that the latest generation of melt filtration equipment needs to live up to

Removal service: screen changers and melt filtration

As recycled plastic becomes increasingly important, it makes sense that melt filtration and screen changer technologies – which help to control the quality of the recyclate – were prominent at K2019.

Germany-based **Britas** launched a new series of piston screen changers at the show. These are aimed at applications where plastic waste is not heavily contaminated.

The continuous (CMF) and discontinuous (DMF) models can be used with both industrial and production plastic waste. They add to the company's existing ABMF, ABMF 1600 & ABMF PET models.

"CMF and DMF screen changers are aimed at customers who want to recycle waste plastics with less pollution," said Friedrich Kastner, chairman of Britas Recycling.

The systems are mainly used in the post-industrial, post-production and new product sectors. Depending on required flow rates and different operating modes, customers can choose between the discontinuous version – which typically has one piston – or the continuous one, which has two pistons.

Basic versions are the CMF as automatic continuous piston screen changer and the DMF as discontinuous piston screen changer – available in square or round execution.

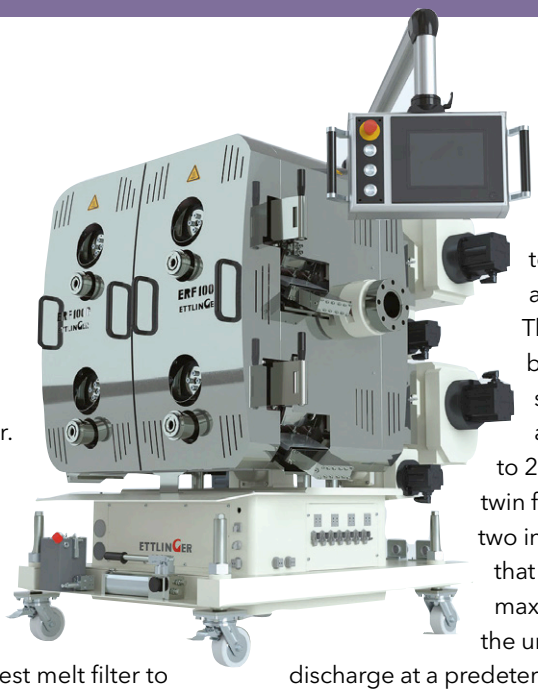
"The DMF-rd is a round case that is heated with ceramic heating bands. This filter is the most cost-effective filter version and is mainly used as a pre-filter for coarse contaminants, as a pump protection or used in reduced space conditions," said Heiko Henss, managing director of of Britas Recycling.

Raised temperatures

The DMF-sq is suitable for higher temperatures (up to 350°C) and higher pressures (up to 500 bar) due to its square housing, and is heated with heating cartridges. Both types can be used for polyolefins, melt adhesives and for many engineering plastics.

The CMF-BF can clean the screens automatically, and a back-flush attachment includes two pistons that automatically perform the back-flushing process. When a filter change is required, one of the two back-flush pistons is moved into the back-flush position first. As a result, the melt inflow

Main image: Britas launched its CMF and DMF piston screen changers at K2019



Right: The ERF 1000 high melt filter is Ettlinger's largest to date and can handle up to 10,000 kg/h

of the corresponding filter is interrupted. A small melt stream of already purified material is diverted and passed backwards through the filter to be cleaned and discharged to the outside. This process is automatically repeated for the second filter.

High throughput

Ettlinger used K2019 to unveil the ERF 1000 melt filter for very high throughputs in plastics recycling. It is Ettlinger's largest melt filter to date: four filter drums provide a total of 6,280 cm² of filtration surface – twice as much as the ERF 500, its previous top-of-the-range model. The ERF 1000 removes foreign particles from polymer feedstock containing up to 18% contaminants. The filter has maximum throughput of 10,000 kg/h depending on the application. Ettlinger says ERF filters are now available in four sizes, starting with the ERF 200 for throughputs up to 800 kg/h.

The new ERF 1000 is self-cleaning and works with a rotating, perforated drum, through which there is a continuous flow of melt from the outside to the inside. A scraper removes the contaminants that are held back on the surface and feeds them to the discharge system. As a new feature, the ERF 1000's four filter drums can be individually replaced without disrupting production. This allows the filter to run continuously and fully automatically, often over a period of several months at a time. Ettlinger says its advantages include low melt losses and good mixing and homogenising of the melts.

Ettlinger is part of Maag, the manufacturer of gear pumps, pelletising and filtration systems and pulverisers.

Below: Key Filters has refined its KCH continuous belt screen changers



Double screen

Fimic showed its latest and largest melt filter at K2019. The GEM model uses two 600mm diameter screens to provide 5,500cm² of filter surface and is intended for use in high volume and highly contaminated recycling applications.

"All customers are increasing capacity and output and are handling more and more different materials with more contamination," said Fimic's sales director Erica Canaia, who explained that the unit can process up to 3 tonnes/h depending on the application.

The new machine, which can be equipped with laser screens from 80-300 microns and mesh screens from 400 to 2,000 microns, combines the twin filters with two scrapers and two independent discharge valves that function automatically. For maximum flexibility in operation, the unit can be set to scrape and discharge at a predetermined pressure or, where high levels of contamination are being handled, to scrape continuously and discharge.

Main applications for the GEM are envisaged for LDPE, LLDPE, HDPE and PP processing but the units can also handle resins such as PS and ABS, as well as EPS.

Canaia said the company is putting the GEM model through its paces at an extrusion machinery producer's site with a full market launch expected this year.

Continuous improvement

Key Filters – part of **Parkinson Technologies** – has made a number of refinements to its KCH continuous belt screen changer. These include more robust construction, cooling enhancements and maintenance features.

"Our engineers, assembly personnel and field service technicians worked closely with our customers to make a great machine even better," said Justin Marriott, product manager of Key Filters. "This recent iteration saw the most advances since the KCH's inception."

To increase robustness, vital machine sensors were guarded, moved further away from high-heat locations and upgraded to meet extreme production environments.

"As an example, the puller sensor was upgraded from a string potentiometer to an extreme-duty, non-contact inductive sensor," said Marriott. "The sensor is proven in demanding applications, such as heavy-duty sanitation trucks."

Other advances include increased cooling through the inlets and outlets, resulting in three times the flow rate of the previous version. This accelerates the formation of the sealing plug, which allows the KCH to advance the screen more quickly – thus filtering out higher volumes of contaminants and reducing the risk of downtime

due to seal failure.

When working with heated polymer, situations that are outside the screen changer's control can arise, which may cause downtime or damage to the machine. These include: increasing the screw speed on the extruder too quickly at start-up; and interrupting the cooling water to the screen changer, which results in a loss of the sealing plug in the screen outlet.

Key Filters looked at ways to reduce potential downtime in these situations by separating the puller and outlet assemblies. The heated polymer bypasses the puller assembly, eliminating component damage and providing an easier clean-up if plug loss occurs. An extrusion line can be fully operational in just a fraction of the time, says the company.

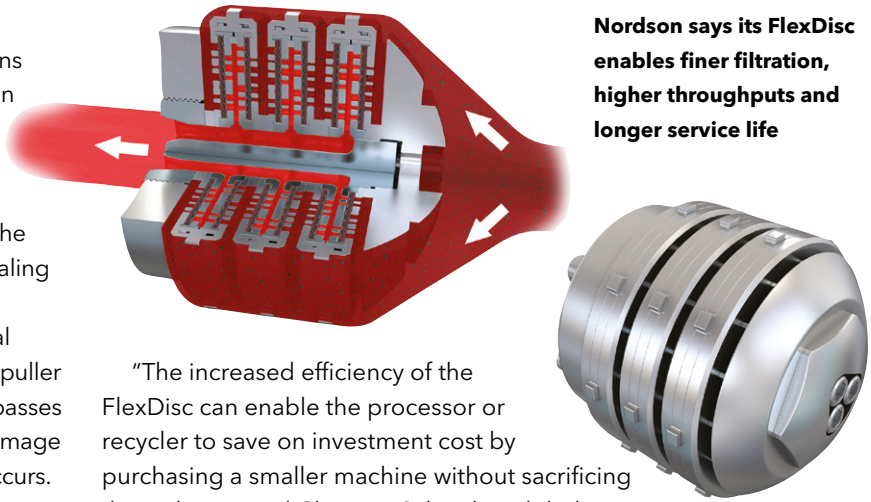
Increased area

Nordson has developed the BKG FlexDisc to provide PET recyclers with more filtration area than standard screens, without an increase in machine size. The company says that the FlexDisc filter for piston-activated screen changers substantially enlarges available filtration area without the need to increase machine size, enabling processors and recyclers to achieve finer filtration, higher throughputs, longer filter service life, and reduced specific backflush volume. Nordson recommends the BKG FlexDisc for increasing productivity and enhancing quality in bottle-to-bottle PET recycling, PET fibre recycling and battery separator film applications.

FlexDisc enables processors and recyclers to achieve finer filtration, higher throughputs, longer filter service life, and reduced specific backflush volume. Nordson recommends it for increasing productivity and enhancing quality in applications such as battery separator film.

The function of the hydraulic pistons is to insert screen cavities into the melt stream for filtration and to remove them for cleaning or replacement. In systems where FlexDiscs are used, each cavity contains a filter stack comprised of two to four FlexDiscs, depending on machine size. Each is equipped with two Nordson screen packs. As a result, there is at least twice the filtration area available for each cavity than with conventional standard round screens, and around 25% more compared to the former FlexDisc version.

Screen changers that use Nordson's backflush technology include the BKG V-Type 3G and BKG HiCon K-SWE-4K-75/RS. Backflushing diverts contaminant from the melt stream. The higher efficiency of the new FlexDisc reduces the frequency of backflushing, says Nordson.



Nordson says its FlexDisc enables finer filtration, higher throughputs and longer service life

"The increased efficiency of the FlexDisc can enable the processor or recycler to save on investment cost by purchasing a smaller machine without sacrificing throughput," said Christian Schröder, global product manager at Nordson. "There are also significant operational savings possible with the reduction of specific backflush volume."

New model

Gneuss showed several variants of its patented Rotary Filtration Systems – continuous filtration systems with a filter disk, on which screen cavities are located in a ring pattern.

Screens can be changed on the part of the filter disk that is not active in the melt channel, while the production process continues to run without any interruptions or disturbances.

A new model, called SFneos, was developed to combine the characteristics of several older models into one simple, cost-efficient solution.

Advantages of the new design include: a guarantee of constant pressure, even during screen changes; suitable for most types of polymers and viscosities; compact design, thanks to an enlarged active screen area (up to 2370 cm^2); simple, safe handling and operation with several screens accessible for screen changes; and cost effectiveness.

The SFneos is aimed at applications that benefit from a continuous, pressure and process constant screen changer, but which do not require back-flushing.

During K2019, the company also exhibited: several sizes of its RSFgenius, with integrated self-cleaning system; and two KF screen changers– a KF 75 with an active screen area of 44 cm^2, and a KF 110 with an active screen area of 95 cm^2 .

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- **www.britas.de**
- **www.ettlinger.com**
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- **www.parkinsontechnologies.com**
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Inside the TiO_2 market

The TiO_2 market has seen considerable volatility over recent years. Future predictions remain challenging but demand is increasing and upward price moves seem likely. Peter Mapleston investigates



PHOTO: SHUTTERSTOCK

Titanium dioxide (TiO_2) is the most widely used pigment in the global plastics industry, with nearly 1.6m tonnes of the product being used annually in compounds based on all polymers and intended for many applications. However, in recent years, the market has become highly volatile. A variety of global factors are contributing to that, including the comings and goings of various Chinese capacities, plant outages, and general economic fluctuations. In addition, an ongoing argument in Europe over health aspects of TiO_2 is not helping calm the waters.

Reg Adams at **Artikol** follows the TiO_2 industry closely and summarises the current situation in demand terms and quantifies the impact that has had on pricing. "Following anaemic growth of 0.6% in 2015, world TiO_2 demand increased by 4.4% in 2016 and by 5.3% in 2017, reaching a peak of 6.475 million tonnes. In 2018, world demand fell by 2.9% to 6.15 million tonnes and it is expected to rise again by 3.3% this year to 6.5 million tonnes," he says.

"The volatility of demand growth has been reflected in the volatility of TiO_2 pigment prices. The average price paid for standard rutile-type TiO_2 pigment in the US dropped to below $2.20/kg in early 2016 before bouncing back to $3.60/kg in Q2 2018," Adams says. "The amplitude of TiO_2 price oscillations has been even greater in Europe and the Asia/Pacific region, where prices have slipped back below the $3.00/kg level."

Some TiO_2 suppliers have been taking measures to address consumer concerns about price volatility, Adams says. Notable among these is Chemours, the world's largest supplier, which introduced its Ti-Pure Value Stabilisation (TVS) initiative at the end of 2017, offering regular customers long-term contracts at "equilibrium prices" that are adjusted in accordance with a pre-agreed and independently-determined index. Tronox has also begun offering longer-term supply contracts (in the order of 12-36 months) at more stable prices, he says.

"So far, there has been a reasonably good uptake on these propositions on the part of customers in the paint industry, but a relatively limited uptake on the part of customers in the plastics masterbatch sector. In a climate where spot prices are heading downwards, customers are

Main image: TiO_2 is a critical pigment for the plastics industry but users have had to deal with intense market volatility in recent years



PHOTO: VENATOR

Right: Venator's new Tioxide TR29 can be used in thin films for applications such as detergent pouches

naturally going to be reluctant to agree to a base price that is too far out of line with the prevailing spot market price," Adams explains.

Last February, **Chemours** introduced a new online portal for customers – called Ti-Pure Flex – saying it will offer a flexible approach for qualified customers purchasing its Ti-Pure TiO_2 without having to make a commitment to buy beyond the accepted order. Pricing and supply commitment can be locked-in for up to six months in advance.

Ti-Pure Flex is said to be akin to consumer portals such as Amazon and Alibaba, according to Bryan Snell, President of Chemours Titanium Technologies, with its offer of a "buy-as-you-need" approach. "It's super simple," he says.

Snell describes Ti-Pure Flex as an industry first and says it is intended for very different customers from those using its Assured Value Agreement (AVA) programme. Primarily, it is designed for those that don't need technical support – AVA customers get priority access to Chemours' technical expertise – and are comfortable with buying small lots in a dynamic pricing scenario. Ti-Pure Flex customers can still access the company's technical resources but they pay extra for it.

Targeting volatility

The AVA pricing model is based on global PPI adjustment over time. "It is amazingly consistent with historical pricing, but it eliminates the volatility," says Snell. Currently over half of all sales of the company's TiO_2 are made through AVA contracts.

AVA has worked better for coatings customers than for plastics customers, as it fitted better into their business model, Snell says. "In the plastics industry, a lot of transactions are ingredients-based. Quite a lot of plastics companies are now buying through Flex, but some are getting more familiar with the AVA concept. Overall, we are very pleased with the uptake of Flex and we expect uptake to accelerate in coming months."

Ti-Pure Flex is offered globally. Snell says there are currently customers using the service in around 110 countries in around 10 different languages. It provides standard pricing by grade and by region. Chemours says it will confirm orders within three business days. Features of the service will change as it matures, the company says.

The TiO_2 supply-demand picture is likely to support higher prices over time, says Snell. "It's about restoration of levels that will support future investment in new capacity." Market watchers have been predicting stronger pricing from the second quarter of 2020 onwards, he says.

Chemours continues to debottleneck its various production facilities and Snell says the company has further options for increasing capacity. "We have great process technology for very cost competitive debottlenecking at locations which also have low manufacturing costs," he says.



PHOTO: CHEMOURS

Above: Chemours Titanium Technologies President Bryan Snell says Ti-Pure Flex provides a "buy as you need" online pricing and supply option

At **TiPMC Consulting**, which provides information, marketing and technical services on the full TiO_2 value chain for financial analysts and business leaders, Managing Director Gerry Colamarino says the Chemours sales strategy separates customers between longer term, more stable pricing AVA contracts "and the majority of other customers purchasing through their portal, mostly on a spot basis, which is measurably higher pricing versus the AVA contract price." He says that as supply tightens, customers not on AVA contracts will pay a higher price and that will gradually increase global pricing.

"We see current demand levels well below trend line, mainly as a result of the recent destocking. Given the current uncertainty surrounding the global economy, it is difficult to precisely predict when pricing will turn upward. Margins have been severely restricted, as the global TiO_2 feedstock industry has been increasing prices during the recent downturn. This has produced increased floor pricing, with many TiO_2 producers, particularly Chinese producers, operating at very low profit margins," Colamarino says.

Performance pigment

Turning from supply and demand to product development, one company extending its product slate is **Venator**. At K2019 last year it launched Tioxide TR29, which the company describes as its highest performing white pigment for low moisture applications and demanding processing conditions. "Combining ultra-low moisture content, with excellent dispersion properties and a high

packing fraction, Tioxide TR29 is designed for use in the manufacture of highly technical thin films, and in engineering polymers where moisture sensitivity is a consideration," Venator says.

"Tioxide TR29 can be used to create masterbatches with a very high TiO_2 loading, while maintaining a high throughput rate and a low specific energy requirement – which can potentially reduce production and transportation costs compared to multipurpose masterbatch grades," says Dr Jörg Hocken, Global Application Manager.

In the manufacture of technical multi-layer films, the company claims, the low moisture content of Tioxide TR29 enables converters to produce thinner films with a reduced risk of lacing. "This enables the manufacture of high quality packaging materials that are less likely to fail from lower raw material utilisation, thereby helping to reduce plastic waste," Hocken says.

Integrated into moisture-sensitive engineering polymers, Tioxide TR29 can provide whitening properties without causing moisture or volatile-induced failure.

Masterbatch option

Lomon Billions also has a new product entry. "Our latest innovation in TiO_2 pigments for plastics is Billions BLR-886 pigment made by the chloride process," says Julie Reid, the company's Marketing Director. "It's particularly suitable for polyolefin masterbatch, high-temperature extrusion coatings, cast films and engineering plastics."

Lomon Billions is on a continuing growth path that for the moment puts it in third place in the global league table of TiO_2 producers. In 2018 it announced an investment of around $285m in the construction of an additional 200,000 tonnes of capacity at its chloride TiO_2 pigment manufacturing site in Jiaozuo; its ambition is to grow its chloride capacity still further (most TiO_2 in China is produced using sulphate technology).



PHOTO: LOMON BILLIONS

Above: Lomon Billions is halfway through a 200,000 tonnes/yr chloride TiO_2 capacity expansion at Jiaozuo in China

The new capacity comes from two lines, each of 100,000 tonnes/yr capacity. The company says commercial production on the first line is already underway, the second line was fully commissioned by the end of last year, with commercial production expected in H1 2020.

The company has also been growing through acquisition. In June, it acquired the Yunnan Xinli site in China to provide further chloride TiO_2 pigment manufacturing capacity. This site has been refurbished, and is expected to deliver around 60,000 tonnes/year of additional chloride capacity, according to the company..

"Our annual manufacturing capacity will grow from 700,000 to around one million tonnes/yr," says Reid. "The additional capacity at Jiaozuo, Xiangyang and Xinli strengthens our global competitiveness and will allow us to increase our chloride TiO_2 pigment portfolio to manufacture more high-performance chloride TiO_2 pigments for a wider range of applications, including growing our portfolio for plastics applications."



PHOTO: TROMOX

Left: Tronox completed its acquisition of Cristal's TiO_2 business following agreement to sell the North American units to Ineos

Cristal deal done

Meanwhile, last April, **Tronox** finally completed its acquisition of Cristal's TiO_2 business. Tronox first made a bid for the business in early 2017, but it was blocked by the US Federal Trade Commission (FTC).

The FTC dropped its opposition after it was agreed that Cristal's North American TiO_2 business would be sold to Ineos Enterprises. With this acquisition, Tronox now operates nine TiO_2 manufacturing plants around the world, giving it the most diverse global footprint in the industry. It is the world's second largest supplier. ›

EC to classify TiO_2 as carcinogenic

The European Commission has decided to move ahead with plans to classify titanium dioxide (TiO_2) as a category 2 carcinogen due to potential inhalation hazards.

The decision follows last month's Competent Authorities Meeting for REACH and CLP Regulations and goes against the advice of the majority of its members, according to the VDMI (the German association representing mineral pigment and masterbatch producers).

It follows a change in the legal process for CLP amendments to allow fast tracking into law as a "delegated act". This means the classification will come into force if no objection is raised by either the European Parliament or Council of Ministers within two months.



"Delegated act" procedure could fast track adoption

VDMI and other opponents of the classification argue that TiO_2 is not toxic but is hazardous due to its particulate nature so should be addressed via occupational exposure limits. They argue that applying the Category 2 carcinogen classification will mean that products – such as plastics and paints – will be labelled as hazardous even where there is no risk of TiO_2 inhalation. Recycling and waste is one area of critical concern, says VDMI, as any product containing more than 1% of TiO_2 will become a hazardous waste and could not be recycled.

› **www.vdmi.de**

"Our newly combined, wide-ranging portfolio of TiOna TiO_2 products continues to offer a combination of desired high-performance characteristics for plastics producers," says Jeff Engle, VP, Marketing. "The joining together of Cristal and Tronox positions us to be in the right place with the right products for our customers."

At **Ineos**, Chairman Jim Ratcliffe says the acquisition of the Cristal units "is a great opportunity for Ineos to enter the pigments market and become the second largest producer of titanium dioxide in the key North American market." Cristal's North American business includes two plants in Ohio.

TiPMC Consulting's Colamarino says Tronox, Chemours and Lomon Billions "form a unique group not seen before in the industry, each bringing unique strengths, with capacity either over or near one million tonnes. Ineos is a new entrant into the industry, with a successful track record of buying undervalued assets and producing excellent cash flows. Ineos brings the advantage of being a private company, with new ideas, methods, and a strong balance sheet into the industry. It's an exciting time in terms of positive changes for an old industry."

Extending pigments

One way to make TiO_2 go further is to use mineral extenders. These are often used in paints, but less so in plastics. One company offering solutions for both is **FP-Pigments**. Its FP-500 Series Opacity Pigments contain what Andy White, Business Unit Director Paints and Plastics, says is "optimally spaced" TiO_2.

"In almost all plastics, the levels of TiO_2 are so low that the spacing is extremely sub optimal," he says. "Nevertheless, it is still the most effective at providing opacity and whiteness. FP-550 in masterbatch and FP 510 in PVC can be used to replace 10-15% of the randomly distributed sub optimal TiO_2 with optimally spaced TiO_2 and thus achieve a similar optical effect at a far lower cost."

White says FP Pigment works in a different way to conventional extenders, "which simply limit the space available to the TiO_2 and push it on average closer together. It is possible to use both technologies in certain applications to further optimise cost versus performance."

In addition, he says that, compared to conventional TiO_2, FP Pigment provides opacity and whiteness without white strength. "This can facilitate the enhanced chroma of coloured pigments in plastics applications when replacing TiO_2 with FP Pigment," he says. "Cost savings on reduced high-cost organic or mixed metal oxide pigments can then be considerable."

Under the weather

Typically, TiO_2 grades for plastics are characterised by high hydrophobicity, which ensures good mixing during compounding and easy distribution in the polymer matrix. However, not every grade of hydrophobic TiO_2 is suitable for production of plastics that are exposed to external weather conditions (UV radiation, humidity), according to Andriy Gonchar, Director at **RD Titan Group Innovative TiO_2**.

TiO_2 is a photocatalyst that absorbs UV radiation, he explains. When that UV absorption takes place in the presence of moisture a cycle of chemical

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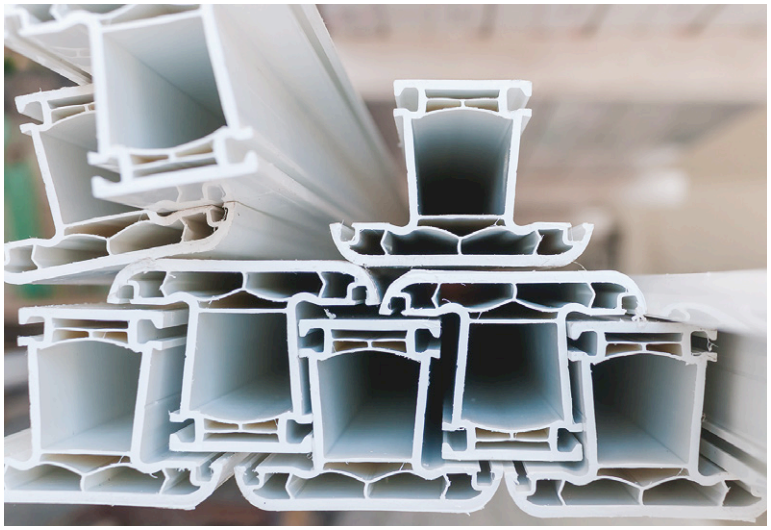
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PHOTO: SHUTTERSTOCK



Above: The EU is about to legislate that all TiO_2-containing products such as window profiles carry health warnings

reactions is initiated leading to the formation of extremely reactive free radicals. These can react with the molecules of the polymer matrix and cause its destruction. This process releases pigment particles enclosed in the polymer matrix, leading to chalking and loss of surface gloss.

To avoid – or to significantly slow – this phenomenon, TiO_2 manufacturers have developed special grades with reduced TiO_2 photocatalytic activity. Gonchar says this is typically achieved by introducing special dopants to decrease photocatalytic activity of the TiO_2 lattice or by applying inorganic surface treatments such as silicon oxide or zirconium compounds. The former are intended to act as a barrier on the TiO_2 surface while the latter capture the free radicals formed.

Gonchar says both TiO_2 lattice doping and surface treatment involve complicated operations with a lot of critical nuances to be taken into account. Therefore, he advises that users take care to evaluate the quality of offered products by conducting their own weathering tests – either accelerated or in real outdoor conditions.

RD Titan Group Innovative TiO_2 has developed its own technology for production of super-durable TiO_2. Its RP-72 grade production technology makes it possible to produce titanium dioxide with superior weather durability, according to Gonchar. It involves the combination of three technologies: TiO_2 particles are encapsulated in a dense silicon oxide; the crystal lattice is doped using a specially developed technology to reduce photochemical activity; and a "free radical scavenger mechanism" is applied to neutralise any free radicals that can form.

More recently, RD Titan Group Innovative TiO_2 has developed an even more durable grade. RP-8829 is said to be exhibit twice the durability of RP-72 (determined as 5% acid solubility for RP-8829 versus 10% for RP-72).

Regulatory troubles

The European Commission is close to legislating that all TiO_2-containing products sold in the EU carry labelling with words and icons warning that the product contains a potential carcinogen (see box story on previous page).

The move is based on toxicological data from two studies in which laboratory rats developed tumours that became cancerous after living for several weeks in very concentrated atmospheres of TiO_2 dust.

"The validity of these studies has been challenged on many grounds," says consultant Reg Adams. He says critics have pointed to the exposure concentrations being extreme (240 mg/m^3), that the rat lungs were chronically overloaded, and that physiological clearance was impaired. It is also pointed out that human cohort studies assessing more than 24,000 people working in TiO_2 factories have not shown an association between exposure to TiO_2 at normal factory concentrations and an increased incidence of lung cancer.

"Nevertheless, the law-drafting process moves ahead inexorably since May 2016, when the recommendation for special labelling was first tabled," he says. "In mid-September 2019, the European Commission declared that it will be submitting the draft legislation for final approval by the European Parliament and the Council of Ministers. The enactment of legislation in the EU might set a precedent for similar regulations to be adopted in other parts of the world. In any event, it may well have a dampening effect on the potential growth of TiO_2 consumption."

TDMA, the trade association representing TiO_2 manufacturers, says the chemical should not be classified as carcinogenic because the proposed mechanism of toxicity is not related to its chemistry, but rather to the size and shape of the particles, as well as to its low solubility. TDMA says "a vast body of scientific evidence" shows that TiO_2 does not cause cancer in humans (**https://tdma.info/titanium-dioxide-is-safe/**).

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- **www.artikol.com**
- **www.chemours.com**
- **www.tipmcconsulting.com**
- **www.venatorcorp.com**
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IMAGE: SHUTTERSTOCK

Case studies are a key feature of this year's Plastic Pipes in Infrastructure conference, which takes place in Hamburg, Germany in April

Learning through case studies at infrastructure pipe event

Main image: Infrastructure piping is increasingly moving away from traditional materials such as concrete

Plastics are increasingly replacing traditional materials – such as steel, iron and concrete – in infrastructure pipe systems.

Safety, cost effectiveness and sustainability are some of the main reasons behind this. Exploring materials such as, PVC, polyethylene and GRP, the *Plastic Pipes in Infrastructure* conference – held in Hamburg, Germany on 28-29 April – will look at pipe systems used in drinking water supply & distribution, gas transmission & distribution, underground drainage & sewerage, and district heating.

Chaired by Lou Reade, editor of *Pipe and Profile Extrusion* magazine, the 2020 event will focus on learning through case studies, providing a forum for driving innovation and creating opportunities for the plastic pipe industry.

Industry projects

Matthias Haese, sales director at **Frank**, will present a case study on using welded PE100 pipes up to ID 3500 for an underground railway station in Stuttgart. He said: "The high degree of automation and the time saving by using e-fusion and extrusion welding are the main reasons why these processes are becoming increasingly important for projects with PE pipes in a large dimension range."

Jose Angel Galera, product manager at Spanish pipe manufacturer **Molecor**, will will describe how PVC-O pipe and fittings were used on the irrigation transformation project of sector XXII, Payuelos Subzone in León, Spain. The case study will address the challenges and successes of using PVC-O.

"It is essential to explain the benefits of molecular orientation applied to PVC," he said. "Thanks to the latest technology for making oriented PVC (PVC-O) pipes and fittings, water infrastructure owners have the opportunity to use a product with a superior mechanical strength with all the chemical benefits of PVC."

As well as pipe fittings, joints will also be discussed within a session compromising **Georg Fischer**, a joint paper between the **Suez Group**, **Aliaxis R&D** and **Suez Water France** and **Victualic**.

"Traditionally, plastic piping systems have been joined via solvents or heat fusion, and there has

been a bias to avoid mechanical joints, used only as repair sleeves when needed," said **Mike Griffin**, director of engineering at Victaulic. "However, many advances have been made in this space, specifically in areas of self-restraint, advanced sealing technologies, and ease of installation. This often makes the mechanical joint the best jointing solution. Today, end users have many more choices available to them, advancing the adoption of plastic pipe into new markets and applications."

Materials and machinery

In addition to case studies, the programme includes several papers on both new machinery and materials developments.

Andrew Wedgner, PE pipe marketing manager at **LyondellBasell**, will present the new developments made by the company on PE100-RC with a high level of disinfectant resistance. **Logstor** and **Dow** will present a combined presentation on the advances made in low temperature district heating. **Patrick Spijkers**, general manager at **Thermaflex Isolatie**, will explain the benefits of PB-1 for pressure piping systems – and what a higher SDR means for district heating.



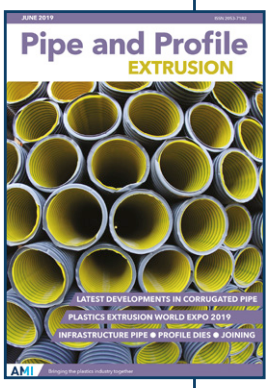
Speakers at the conference include (left to right): Matthias Haese of Frank; Mike Griffin of Victualic; and Jose Angel Galera of Molecor

Machinery companies are represented by **iNOEX**, **Wiedenbach Apparatebau** (part of Domino Industrial), **IPM**, **BC Extrusion Holding** and **Tecnomatic** – which will join the other speakers and testing companies (**Kiwa Technology**, **DVGW Cert** and **Rise Kimab**).

The conference will take place on 28-29 April in Hamburg, Germany.

View the full conference programme **here** or contact Nicola Charlesworth (**nicola.charlesworth@ami.international**), conference portfolio manager for compounding, composites and infrastructure on +44 (0) 117 314 8111.







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MASTERBATCH

High tint from car tyres

At K2019, Cromex launched a new high-tinting capacity line of black masterbatches based on carbon black recovered from used car tyres.

The Brazilian company said its rC-Black line of masterbatches can be used in applications ranging from packaging through to automotive components. Grades are available for a variety of resins, including PE, PP, PET, PS, ABS, SAN, PBT and POM.

Cromex says that, as each tonne of rC-Black masterbatch uses 250 end-of-life tyres, it can make a considerable contribution to meeting sustainability goals.

Key claimed features include good dispersion, strong colour intensity and high tinting power.

› **www.cromex.com.br**

WPCs

WPC decking applied to cladding applications

Trex, the US manufacturer of wood-plastic composite (WPC) decking and railing, has launched a cladding product to its range.

The company says that its new offering makes hardwood planks obsolete, as it offers fade and stain resistance while eliminating the need for annual sanding and sealing.

The product uses square-edge deck boards and can be applied horizontally or vertically. The open-joint façade system promotes airflow over the water-resistant barrier behind the cladding, providing protection for any rainscreen assembly, says the company.

Trex Transcend boards are made from 95% recycled plastic and reclaimed wood scrap.



They are backed by a 25-year product and fade & stain warranties – for both commercial and residential projects.

"Rainscreen is extremely popular right now and is a natural extension for us," said Adam Zambanini, president of Trex Residential. "The attributes of our Transcend boards make them ideally suited to outperform wood in rainscreen applications."

The highly impact- and scratch-resistant material is tested to withstand hurricane-force winds and is code compliant for all Type V-B structures under 40 feet in height, says the company.

The product resists fading, staining, scratching and mould – and will not rot, warp, crack or splinter.

Trex Cladding was at the International Builders' Show in the US in January.

› **www.trex.com**

CONSTRUCTION

Foamed pipe and lightweight panels

Sabic launched several materials at K2019, aimed at construction industry applications.

Its lightweight Stadeck heavy duty panels – made from a thermoplastic resin reinforced with glass fibre – are applicable to a range of applications. Typical uses include scaffolding and non-permanent platform. The material is light and robust, is resistant to fire and chemicals and has good anti-slip properties.

At the same time, the company has created a foamed pipe insulation solution that saves energy and also helped to control condensation and noise – while protecting against pipe fracture. The pipe, which uses Cohere material as a building block, is easy to install and offers design flexibility.



The company claims that it is also more easily recyclable than existing elastomeric foamed pipe insulation.

The company also showcased voltage cable ducts made from its Vestolen A Rely 5944HT material – which can operate at elevated temperatures and for an extended lifetime. These ducts are typically used in solar and wind farms.

› **www.sabic.com**

INSTRUMENTATION

Contactless gauge offers fast, precise measurement of tubing in laboratory

Zumbach says that its GaugePro offers a fast, precise way to measure and record tubular samples in the laboratory.

Conventional contact measuring equipment – such as calipers, micrometers and dial gauges – rely heavily on the skill of the person making the measurement. Different handling of the tools may result in significant variations in results.

The new device can measure tubular samples in a contactless way. Using ultrasonic technology, dimensions such as wall thickness, inside diameter and outside diameter are measured instantly. In addition, ovality and eccentricity can be determined.

An inserted sample is measured immediately at four fixed measuring points. Due to the rotation function, the measurement can be extended to eight measuring points. This increases the coverage around the product and all variations in wall thickness become visible. Automatic self-calibration ensures that the measured values are accurately and reliably recorded even under changing environmental conditions.

All measured values are displayed on a large user interface. Several measured tube samples can be summarised in a common statistic. Logging the measurement results is thus fast, easy and reliable.

Two variants are currently available: GaugePro 8 covers a diameter range from 2.5 to 8mm, while GaugePro 22 can measure tube samples from 6.8 to 22mm.

› **www.zumbach.co**

MEASUREMENT

Gauging length and speed

NDC has developed a length and speed gauge for measuring the production of long, continuous cylindrical products.

These types of products are not always well-guided, and can move off-axis or out of the measurement range. This makes it difficult for traditional Laser Doppler Velocimetry (LDV) gauges to keep the laser on the product's surface. This can result in hard-to-obtain or unreliable length and speed measurements.

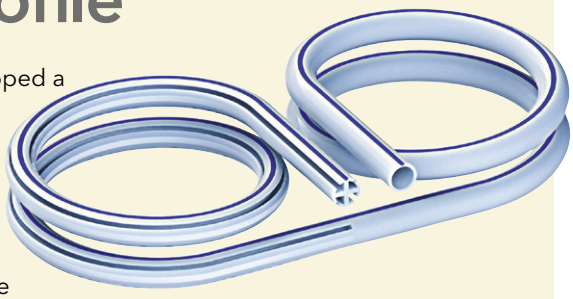
NDC says that the LaserSpeed Pro M series gauge – part of the Beta LaserMike product family – solves the problem. The patent-pending gauge uses a new type of LDV optical technique to provide reliable length and speed measurements of small, bouncing and unguided cylindrical moving products.

This includes small plastic pipe, tube and hose, and other hard-to-measure cylindrical products. The gauge helps manufacturers control product speed and process functions in challenging applications – resulting in less product give-away, less scrap, higher productivity and reduced downtime

› **www.ndc.com**

TOOLING

Reciprocating head alters tube profile



Guill Tool has developed a new reciprocating head, which automatically alters a tube's profile.

Here, the traditional tip and die assembly is replaced with a linear reciprocating assembly that changes the tube's profile within a given length. This process is repeated throughout a single extrusion run without interruptions. Cutting capability, in association with the extrusion speed, cuts the finished product to length.

Both cost and value stream activities are reduced, while quality is improved, says Guill. Only one extrusion run is needed to produce a finished product, rather than multiple extrusion runs with tooling changes along with a manual assembly operation to connect different tubing shapes.

The reciprocating head eliminates an assembly operation, as well as in-process inventory.

This means there is no need for storing various tubing shapes and connectors needed for assembly, fulfilment of orders and replenishment of finished goods.

The head also eliminates a connecting piece, allowing JIT production and made-to-order products.

In addition, it reduces total run time from receiving the order to shipping.

› **www.guill.com**

Fire Retardants in Plastics

Cleveland / 2020

Exploring trends and technical developments in the international flame retardant industry

March 31 - April 1, 2020
The Westin Cleveland Downtown, Cleveland, Ohio, United States





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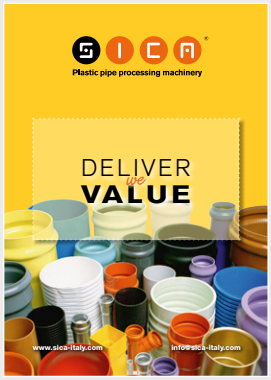
STRUKTOL: PLASTIC ADDITIVES



Struktol offers an extensive range of additives to enhance processing and performance of virgin and recycled plastic compounds. Products range from dispersants and wetting agents, through lubricants to compatibilisers.

› CLICK HERE TO DOWNLOAD

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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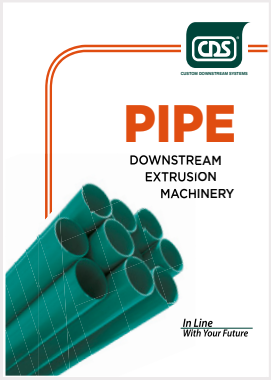
HEXPOL: DRYFLEX TPE



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.

› CLICK HERE TO DOWNLOAD

CDS: PIPE PRODUCTION



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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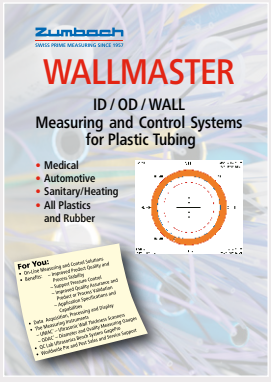
UNICOR: PIPE CORRUGATION



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.

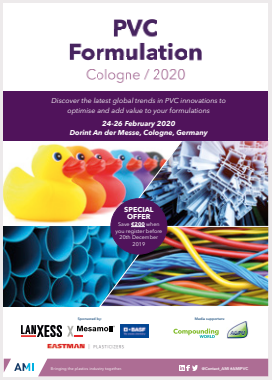
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Learn more about AMI's upcoming conferences

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

PVC FORMULATION EU



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 2020



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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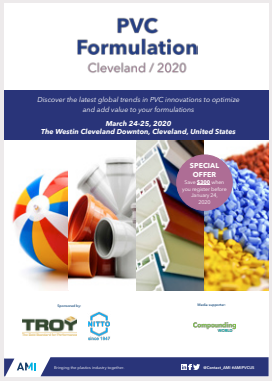
PLASTICS REGULATIONS EU



The 4th edition of Plastics Regulations provides advice on a range of compliance issues at one event. The event takes place on 11-12 March 2020 in Cologne, Germany. The conference provides an ideal environment for regulatory updates.

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PVC FORMULATION USA



The 2020 edition of AMI's North American PVC Formulation conference will be held in Cleveland, Ohio, USA, on 24-25 March 2020, providing a forum for formulators, compounders and suppliers to identify future material and processing trends.

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PLASTIC PIPES IN INFRASTRUCTURE



The 8th Plastics Pipes in Infrastructure conference focuses on the latest technical developments plastic pipes for water, gas, drainage and district heating applications. The conference runs on 28-29 April 2020 in Hamburg, Germany.

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PROFILES USA



The North American profile extrusion market is demanding and fast changing. Taking place in Cleveland, OH, USA, on 2-3 June 2020, AMI's Profiles USA conference will identify key market trends and identify technical innovations.

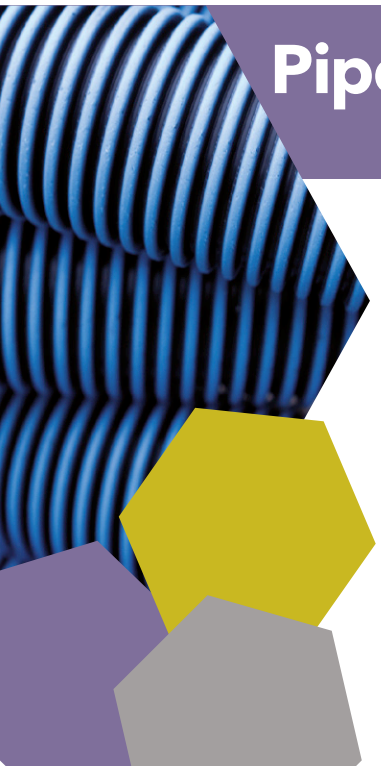
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To see our full line-up of more than 50 plastics industry events over the next 12 months, please visit www.ami.international/events

Teel Plastics

Head office:	Baraboo, Wisconsin, USA
President:	Tom Thompson
Founded:	1951
Ownership:	Private
Employees:	Around 250
Sales (2018):	Around US$50 million
Profile:	Teel Plastics began life as Insemikit – a specialist manufacturer of agricultural products including those for artificial insemination of livestock. At the time, it anticipated the need for plastic tubing to replace glass. The company has since grown into a producer of a multitude of extruded plastic products – including medical tubing, gas pipe and custom profiles.
Product lines:	The company offers a broad range of extruded products. It processes more than 50 different thermoplastic resins, ranging from HDPE and PVC to Peek and polyamide. One core area of expertise is flexible PVC tubing, for applications including IV lines, enteral feeding, irrigation and smoke evacuation. Typical options include DEHP-free and non-phthalate formulations, compatibility with gamma sterilisation and clear or frost finishes. Teel also offers industrial piping – for pressure pipe, oil and gas and other markets – and high temperature products.
Factory location:	Teel's flagship facility houses 27 extrusion lines, making pipe from 1 to 3.5in in diameter. These include co-extruded products up to seven layers. The 150,000 sq ft factory includes a Class 100,000 clean room. Recently, the company supplied 2,800 feet of polyamide 12 pipe for the first phase of a gas installation project in Henderson County, Kentucky.

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:

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

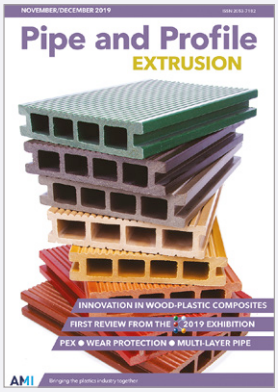
April 2020
Control & instrumentation
PE100+ developments
Materials recovery/granulators
Standards & testing

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

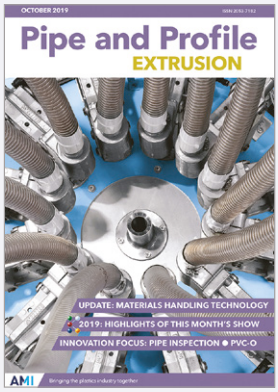
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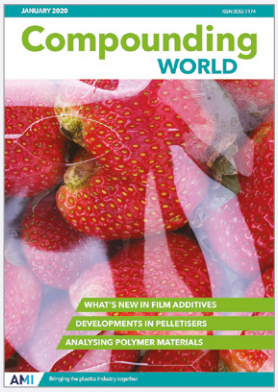
Pipe and Profile
November/December 2019
The November issue of Pipe and Profile Extrusion surveys the latest developments in wood-plastic composites, multi-layer pipes and PEX pipes and investigates methods for reducing wear in extruder screws and barrels. Plus news from K2019.

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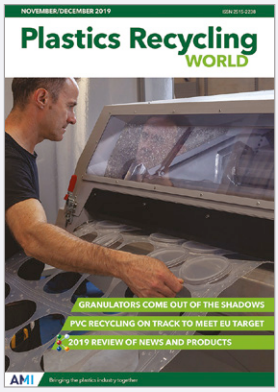
Pipe and Profile
October 2019
The October edition of Pipe and Profile Extrusion magazine looks at the latest developments in materials handling equipment. It also details some innovations in pipe inspection and PVC-O technology, as well as previewing the K2019 show.

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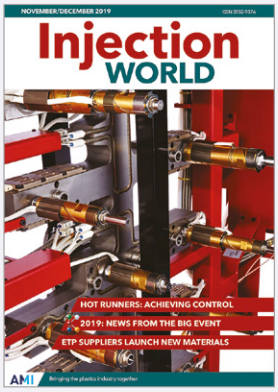
Compounding World
January 2020
The first edition of Compounding World in 2020 explored the latest developments in additives for film materials. It also looked at some of the most recent innovations in pelletisers and polymer analysis equipment.

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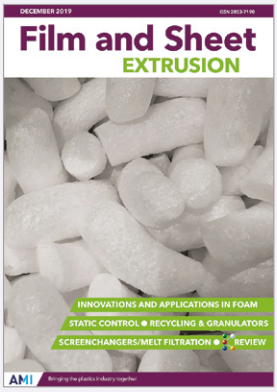
Plastics Recycling World
November/December 2019
The November-December issue of Plastics Recycling World explores the growing importance of granulators, updates on PVC recycling and reviews the recycling highlights of the K2019 show.

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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.

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Film and Sheet
December 2019
The December 2019 edition of Film and Sheet Extrusion looks at the latest developments in foamed sheet. It also reviews new introductions in melt filtration, static charge control and granulation equipment, plus some of the best from K2019.

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

GLOBAL EXHIBITION GUIDE

2020	**3-5 March**	JEC World, Paris, France	www.jec-world.events
	9-11 March	Plast Alger, Algiers, Algeria	www.plastalger.com
	11-12 March	Plast Expo Nordic, Helsinki, Finland	www.plastexpo.fi
	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
	12-15 May	Elmia Polymer, Jönköping, Sweden	www.elmia.se
	13-15 May	Plastic Expo, Osaka, Japan	www.plas.jp/en-gb.html
	19-22 May	Plastpol, Kielce, Poland	www.targikielce.pl
	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
	15-18 June	Plastivision Arabia, Sharjah, UAE	www.plastivision.ae
	16-19 June	FIP, Lyon, France	www.f-i-p.com
	24-27 June	Interplas Thailand, Bangkok, Thailand	www.interplasthailand.com
	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

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