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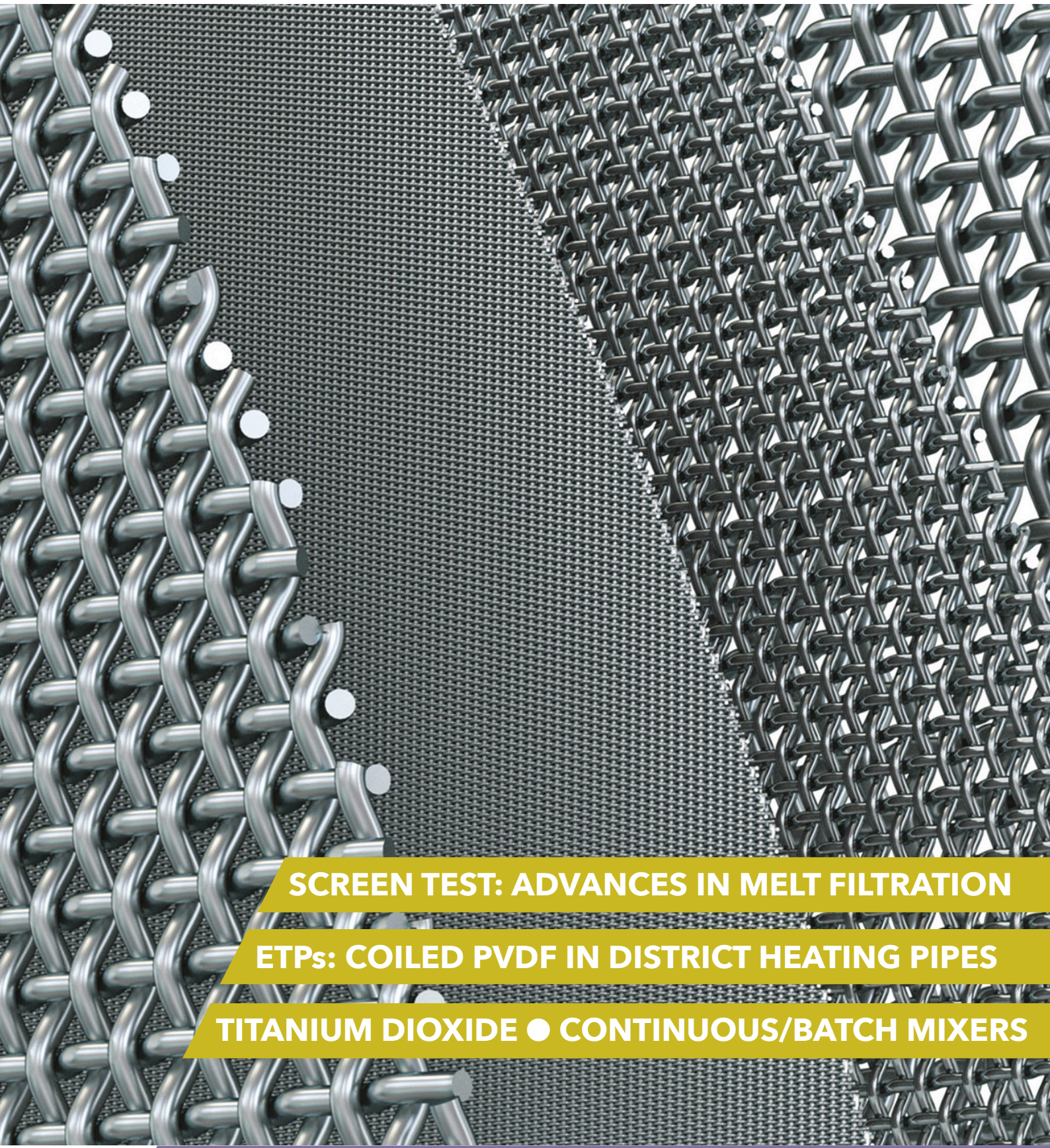
Pipe and Profile EXTRUSION



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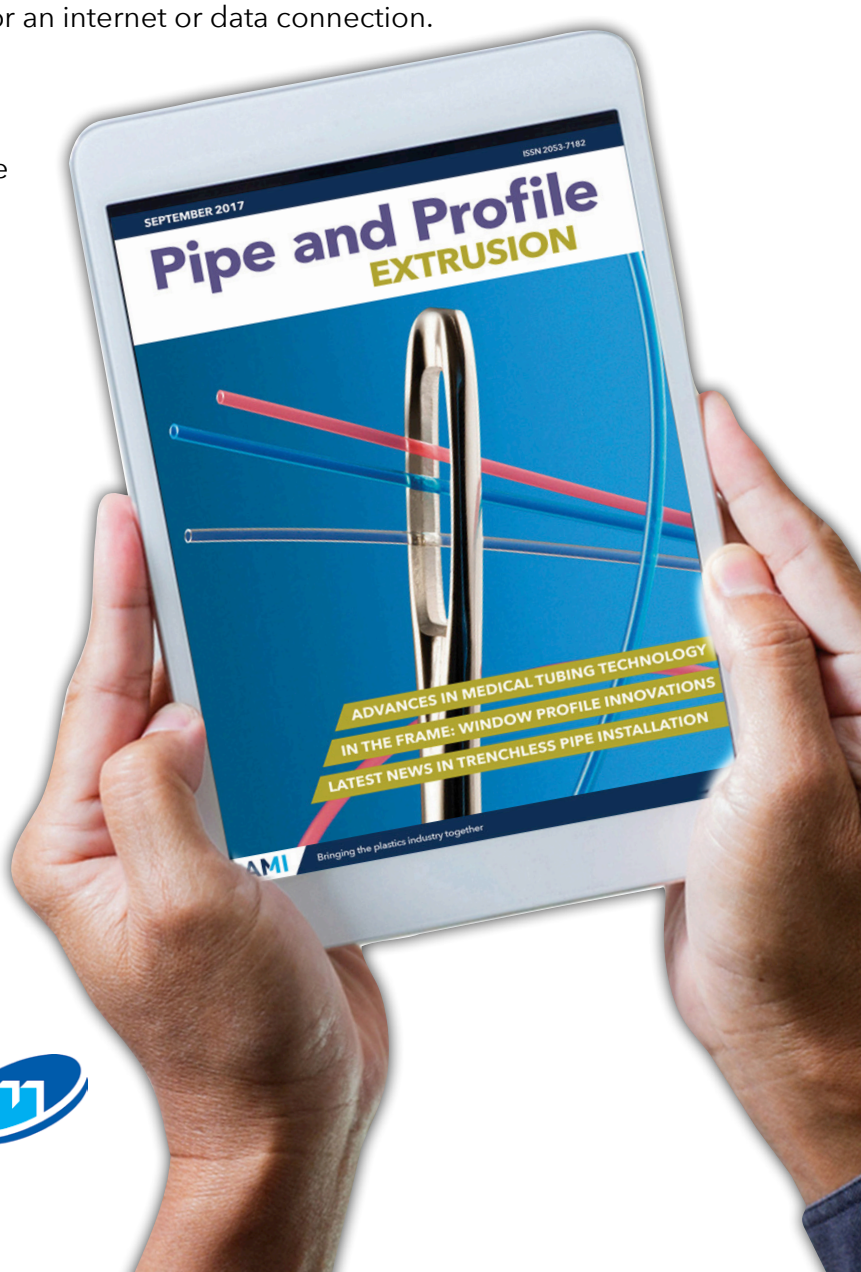

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US plastics industry jobs and sales 'grow sharply'

The US plastics industry saw a rise in both shipments and employee number in 2017, according to the latest figures from the Plastics Industry Association.

In its 2018 Size & Impact Report, the organisation says that the industry employed 989,000 people in 2017 (an increase of 2.4% on the previous year) and generated more than US$432 billion in shipments – a 7% growth.

"The fact that these figures grew so sharply in 2017 is a testament to the industry's overall economic activity during that period of time, and to its ability to expand its impact into areas that might not occur to most," said Perc Pineda, chief economist at the organisation. "The impact of the industry ripples out far beyond its government-defined borders."

When suppliers to the industry are included in the figure, the employment total doubles to around 1.81 million people, while shipments exceed US$590bn.

"The fact that the industry continues to grow shows how effective [plastics] are in their intended use," said Patty Long, the organisation's CEO and interim president.

She called on the government to make funds available to increase the domestic capacity for recycling plastics.

"This will help recover more material, increase jobs, and meet growing demand for recycled content while helping the environment by reducing the amount of plastics needlessly heading to landfills," she said.

› **www.plasticsindustry.org**

Pipe production in Turkmenistan

Eshretly Kenar, based in Bayramali in Turkmenistan, has begun production of plastic water pipes at a new plant in the city, according to the *Orient* news agency.

The plant will start with a capacity of around 250 tonnes/year of polyethylene and polyproplylene pipe, in diameters of 20-60mm. The production plant will also make bags and film.

The raw material is supplied from the new Kiyanli chemical complex in western Turkmenistan, which opened in October last year.

Tekni-Plex adds tubing in China

Tekni-Plex has expanded the range and capacity of silicone tubing manufactured at its plant in Suzhou, China.

An extra line is now producing smaller sized tubing – down to 0.2mm inside diameter, 0.1mm wall thickness and tolerances as low as +/- 0.03mm – for a range of medical pump applications, including peristaltic and patient-controlled analgesia (PCA) pumps.

"Supplying tight tolerances in silicone tubing from our China facility will be of interest to pump manufacturers who assemble their medical devices in the region and have had challenges sourcing quality tubing," said Bob Donohue, general manager of Tekni-Plex subsidiary Natvar.

› **www.tekni-plex.com**

Wider use of PA12 for gas pipe will save costs

Above: Evonik says new rules could help gas distributors save on material costs

Evonik says a recent decision by the US Department of Transportation's Pipeline and Hazardous Material Safety Administration (PHMSA) – to allow wider use of polyamide 12 pipe in the oil and gas industry – could lead to substantial savings.

"We are very excited about this announcement," said Doug Weishaar, business development manager of Evonik's high performance polymers division. "The addition of polyamide 12 to the federal code provides new material options for local natural gas distributors seeking to install new, repaired, or replaced pipelines operating at up to 250 psig."

As a result of the final rule's updated changes, the cost of materials to produce new pipe is estimated to be reduced by 10%, resulting in annual material cost savings of around US$32 million for transmission, gathering, and distribution operators, said PHMSA.

The company says that its Vestamid PA12 is already widely used in the industry.

› **www.evonik.com**

Industry leaders to debate the future of extrusion at US event

Influential industry representatives will take part in four focused debates in the Pipe and Profile Extrusion theatre at the first Plastics Extrusion World Expo. This will be held at the Huntington Convention Center in Cleveland, Ohio, USA on May 8-9, 2019. Admission to the tradeshow and its conference theatre will be free-of-charge to visitors who register in advance **here**.

The four debates will cover the future for plastic pipes, construction profiles, medical tubing, and wood-plastic composites (WPCs). They will feature senior managers from an array of leading players in these fields. The discussions will be chaired by Lou Reade, the editor of *Pipe and Profile Extrusion* magazine.

Technical trends in plastics profiles for construction applications will be discussed by a panel including Paul Adams, materials engineering director at **Deceuninck**, a global leader in the production of PVC profiles. He will be joined by George Walrath, senior scientist with **CertainTeed**, which is a leading North American brand for exterior and interior building products. Also lending his expertise to the panel will be Keith Scutter, the owner of **Resource Plastics**, a consultancy offering design, management and sourcing services for profile extrusion.

The debate on the future for pipe extrusion will feature Dave Fink, senior vice president at **WL Plastics**, which specializes in polyethylene pipes. Providing an overview of industry opportunities and issues will be Tony Radoszewski, president of the **Plastics Pipe Institute**.

The future for medical tubing will be debated by senior representatives from significant players in this high-value and dynamic market. They will include:

Participants in the free-to-attend industry debates include: Tony Radoszewski, president of the Plastics Pipe Institute; Pradnya Parulekar, vice president of global business development at Raumedic; Marcia Coulson, president of Eldon James; and Paul Adams, materials engineering director at Deceuninck

Pradnya Parulekar, global vice president for business development at **Raumedic**; Marcia Coulson, president of **Eldon James**; and Christian Herrild, director of growth strategies at **Teel Plastics**.

America is a pioneer in the use of WPCs or plastic lumber and this major market will be the subject of a special debate at the Plastics Extrusion World Expo. The panellists will include: Matt Breyer, president of the **North American Decking Association**, and Paul Schmitt, the founder of **Envirolastech**.

If you are a senior manager at a pipe, profile, WPC or medial tubing extruder and would like to join the panel for one of these debates, then please contact Charmaine Russell for details at **charmaine.russell@ami.international**.

Organised by AMI, the Plastics Extrusion World Expo will take place alongside the Compounding World Expo and the Plastics Recycling World Expo. By registering in advance, visitors will receive free admission to all three exhibitions, featuring more than 200 suppliers, plus free entry to five conference theatres hosting technical presentations, educational seminars and business debates. Attendees and exhibitors will also have the option to buy tickets (just $20 each) for a networking party at Cleveland's Rock and Roll Hall of Fame on the evening of May 8.

Rita Andrews, head of exhibitions at AMI said: "Our debut expos in Essen, Germany attracted 4,024 visitors, and we are confident that our first Cleveland shows will build on this success and be the biggest plastics industry gathering in the USA in 2019".

The three expos, which will occupy the two largest halls at the Huntington Convention Center, will feature a wide array of leading manufacturers of extrusion, compounding and recycling equipment, plus suppliers of a huge variety of polymers, additives and related services.

A number of companies are already signed up as exhibitors, including: Advanced Blending Solutions, Azo, BASF, Bausano, Cabot, Chemours, Clariant, Davis-Standard, Dr Collin, Doteco, Farrel Pomini, FB Balzanelli, Ferro, Greiner Extrusion, KraussMaffei Berstorff, Labtech, Maag, Maguire, NFM, Nordson, Parkinson Technologies, Reifenhauser, SI Group, Sikora, Struktol, Zeppelin, and over 180 additional leading suppliers.

› **ami.ltd/Register-AMI-Expos**

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Over 200 exhibitors book space at free Cleveland plastics shows

More than 200 companies have already booked booths at three exhibitions focused on plastics extrusion, recycling and compounding. The free-to-attend tradeshows and their associated conferences will take place at the Huntington Convention Center in downtown Cleveland, Ohio, USA on 8-9 May 2019.

AMI's Plastics Extrusion World, Plastics Recycling World, and Compounding World Expos will feature processing machinery, auxiliary equipment, polymer materials, additives and related services.

"Visitors to the focused shows will be able to compare a huge range of suppliers and new technologies in one convenient location," said Andy Beevers, AMI's events and magazines director. "In addition, they'll be able to learn from expert speakers in the five free-to-attend conference theatres and network at the after-party at Cleveland's Rock and Roll Hall of Fame," he added.

The 200+ companies that have already booked booths include: Alpha Marathon, Addex, Advanced Blending Solutions, BASF, Brabender, Buhler, Buss, BYK, Cabot, Chemours, Clariant, Cloeren, Colines, Coperion, Cumberland, Davis-Standard, Dover Chemicals, Dr Collin, Entek, Erema, Exxel Polymers, Farrel Pomini, Ferro, Gneuss, Greiner Extrusion, Heritage Plastics, JSW, Konica Minolta, KraussMaffei Berstorf, Kuhne, Leistritz, Lubrizol, Maag, Maguire, Matsui, Milliken, NFM, Nordson, Oden Technologies, Omya, Pall, Parkinson Technologies, PSI-Polymer Systems, Reifenhauser, SI Group, Starlinger, Struktol, Vecoplan, Wacker, Zoltek, and over 150 more suppliers from around the world.

Above: The Cleveland event will build on the success of AMI's first free-to-attend exhibitions held in Essen, Germany last year

The limited number of remaining booths are being filled on a daily basis. Prices start at $3,400 for a 100 sq ft booth. To find out more about exhibiting at any of the expos, visit **https://www.ami.international/exhibitions**.

"The exhibitions will build on the success of AMI's first tradeshow for the plastics compounding and recycling sectors, which took place in Essen, Germany last year and attracted more than 4,000 visitors," said Rita Andrews, AMI's head of exhibitions. "We are confident it will be the biggest plastics industry gathering in the USA this year."

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

European machine sales to Russia slump

Grassi: "Despite uncertainty in Russia, Interplastica has strategic importance for Italian manufacturers"

Germany and Italy saw mixed fortunes in their exports of plastics machinery to Russia last year.

While Germany raised its sales by around 3%, Italy's sales to Russia fell by nearly 20%.

Both sets of figures – which represent the first three quarters of 2018 – were produced ahead of the countries exhibiting at the Russian Interplastica show.

The increase in German exports comes on the back of a huge 34% rise in sales to Russia in 2017. This, in turn, followed three years of shrinking sales to the region. Full-year exports to Russia are expected to be around €117m – a long way short of its 2013 sales of nearly €219m, said trade body VDMA.

Italy also enjoyed strong sales in 2017 – but these are likely to decline to around €64m for 2018. Extruders were identified as one of the main "victims" of the sales slump, said trade association Amaplast.

"In spite of persistent uncertainties in the Russian market, Italian manufacturers consider [Interplastica] to be of strategic importance in presenting their technological innovations," said Alessandro Grassi, president of Amaplast.

› **www.amaplast.org**
› **http://plastics.vdma.org**

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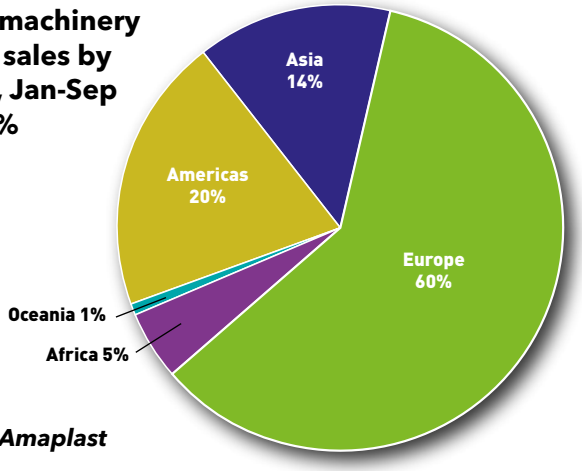
Italy slowdown sees decline in foreign plastic machinery sales

Italian exports of plastics machinery declined slightly in the first nine months of 2018 – though imports again saw healthy growth.

Overall, exports for the period fell by 0.6%. While the trend is positive for extrusion lines, and both injection and blow moulding machinery, it fell away for ancillary equipment and moulds.

Exports to the Far East grew by almost 10%, thanks mainly to India and South Korea, while those to the Middle East fell by around one-third. There was also a 6.5% growth in exports to North America, but a decline of nearly 13% to South America. Sales to North Africa also saw a healthy 13% growth.

Italian machinery export sales by region, Jan-Sep 2018, %



Source: Amaplast

And, while sales within the EU were flat, those to the rest of Europe were up by 12%, but those to Russia declined.

Amaplast's most recent mid-year survey of its members reveals slightly that fewer than half expect stable turnover at the end of the current half-year – while one-third expect continuing growth.

"We expect year-end production and foreign trade to be roughly in line with 2017," said Amaplast. "This must be considered a positive result, given that 2017 was the best in the past five years."

Amaplast says it has a cautious outlook for 2019.

› **www.amaplast.org**

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A joint study has identified the feasibility of using coiled PVDF for slipline rehabilitation of district network heating pipes

Putting PVDF to work in district heating pipes

In 2016, there were 4,500 district heating networks present in a total of 32 countries. In France alone, these networks represent around 5,000km of piping.

For the most part, district heating networks comprise pairs of parallel steel pipes: one is for the distribution of hot water, overheated water or steam; the other, which is generally smaller in diameter, is for the return of condensates. The heat-transporting pipe is insulated, usually with glass wool, in order to limit energy loss, while the condensate return pipe is coated with a protective substance (such as polypropylene) to prevent corrosion.

The overall system is installed within a concrete duct which is usually buried 1-1.5m deep.

Given the operating conditions of these networks, corrosion problems are unavoidable – and leaks are inevitable. In the urban environment, repairing leaks and renewing these networks is costly and disruptive. To limit recurrent leaks, particularly in the pipes carrying condensate, it is worth considering non-metallic pipes that can withstand the required temperature and pressure – and are not prone to corrosion.

Technical requirements

The search for polymers capable of meeting the requirements of district heating networks has focused on those whose thermal and mechanical performances surpass those of conventional polyolefins. The need to resist permanent high temperatures and pressure for long durations requires:

Main image: PVDF copolymer grades had the correct balance of stiffness and coilability to be used for pipes in district heating systems

Right: Metal district heating pipes require frequent replacement due to corrosion

- A high-performance stabilising system (anti-oxidants) to slow chemical degradation of the polymer matrix, especially through oxidation;
- A polymer matrix with minimal sensitivity to oxidative attack, independent of the stabilising system in the matrix; and,
- A macromolecular and crystalline structure that significantly impedes slow creep-crack growth at high temperatures.

The first requirement requires modification of conventional polymer solutions, such as polybutylene (PB), polyamide (PA) and polyethylene (PE). Cross-linked polyethylene (PEX) and polyethylene of raised temperature resistance (PE-RT), or even polybutylene (PB), would meet these demands, but only for a permanent operating temperature of 110°C or less – and, for limited operational lifetimes. Regardless of how effective the stabilising system in the polymer matrix might be, its effectiveness over time will be limited, due to the low amount that can be incorporated into the matrix – which is susceptible to photo-thermo-oxidative attack due to its molecular structure.

The second requirement calls for a polymer matrix that is almost impervious to any kind of oxidation, due to the limited number of sites liable to oxidative attack on the carbon chain, through partial or complete substitution of the labile hydrogen atoms.

The third requirement calls for a semi-crystalline molecular structure, which also allows it to respond to additional requirements such as the ability to be shaped (pipes and fittings) and fuse-welded, as well as suppleness (allowing the pipe to be coiled onto a spool).

Non metallics

In addition, the typical conditions that non-metallic substitutes will have to deal with in district heating networks include:

- Nominal pipe diameter: 40mm to 600 mm;
- Internal pressure: 3 to 6 bar;
- Sustained operating temperature: 110°C (and up to 130°C);
- Operational lifetime: 10 years or more;
- Sliplining using coiled pipes (environmental constraint);
- Use of electrowelding or butt-welding for joints; and,
- Resistance to the pH of the water transported: 9.1.

Taken together, these technical requirements point to partially-fluorinated polymers such as polyvinylidenedifluoride (PVDF), or ethylene chlorotrifluoroethylene (E-CTFE). Polytetrafluoroethylene (PTFE) is omitted from the list of solutions due to technical limitations linked to its shaping, and its unsuitability for welding or gluing – a consequence of its high thermal stability due to the saturation of the repeat unit of the carbon chain by four fluorine atoms. In fact, the increased number of substituted fluorine atoms increases the thermal stability of the material to the detriment of its ability to be shaped and welded.

PVDF promise

PVDF is a fluorinated thermoplastic that is white to translucent in colour. It was originally exploited for its electrical and piezoelectrical characteristics, and was later used to make coatings – and, eventually, for pipes and accessories in the chemical and pharmaceutical industries due to its high chemical purity, low permeability and resistance to most chemical compounds. The high chemical and thermal resistance of PVDF arises from the partial saturation of the carbon chain by two fluorine atoms in the repeat unit of the polymer.

PVDF is a semi-crystalline polymer whose continuous operating temperature interval lies between −30°C and +150°C. Its glass transition temperature (where it passes from the glass state to a 'rubbery' semi-crystalline state) is at about -40°C. It is easily shaped into pipes, fittings and moulded pieces using conventional extrusion and injection techniques. The available pipe diameters generally range from 16mm to 315mm, but the

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system standard covers diameters up to 400mm.

PVDF pipes can be joined using either mechanical fittings or welding. As regards welding, four proven techniques are generally used:

- Electrofusion using electro-weldable sleeves, which are available for pipe diameters of 20-63mm. The technique is almost identical to that used for PE;
- 'Socket fusion' using a male-female type sleeve, available for pipe diameters of 16-110mm;
- Butt-welding using heating mirrors, for pipe diameters of 20-630mm; and,
- Contactless, infrared, butt-welding, for pipe diameters of 20-450mm.

Other techniques, such as high frequency welding, hot gas welding or friction welding can also be used. However, they appear more suited to the laboratory environment due to the operational constraints existing in the field.

Coiling ability

PVDF has a greater stiffness than most other polymers. This is related to its higher density, which is about 1.8 times that of HDPE, for instance. However, this stiffness is about a quarter that of steel. This stiffness factor can constitute an obstacle to its ability to be coiled or wound onto a spool, as is usually the practice with PE pipes. Consequently, PVDF pipes are usually only available in straight lengths.

The need for new pipes that can be used for sliplining of existing corroded steel pipes – over lengths exceeding those currently available (5m as standard) with a limited number of welded joints – meant that the feasibility of rolling/unrolling such pipes had to be demonstrated. To this end, a joint study was launched between GRTgaz's Research and Innovation Center for Energy (RICE), Solvay Specialty Polymers and RYB-Groupe Elydan. The study, which began by using digital simulation of the coiling process, helped the researchers to select – from several possible available grades – the material with the best compromise in terms of 'coilability' and long-term mechanical performance.

Preliminary digital simulations were needed in order to evaluate the effort required to coil the pipe onto a spool, as well as the damage caused to the wall of the PVDF pipe as a function of the coiling radius. These simulations were carried out by Solvay using a finite element model implemented on the Abaqus platform. The material input data was that of the Solef 1010 grade homopolymer.

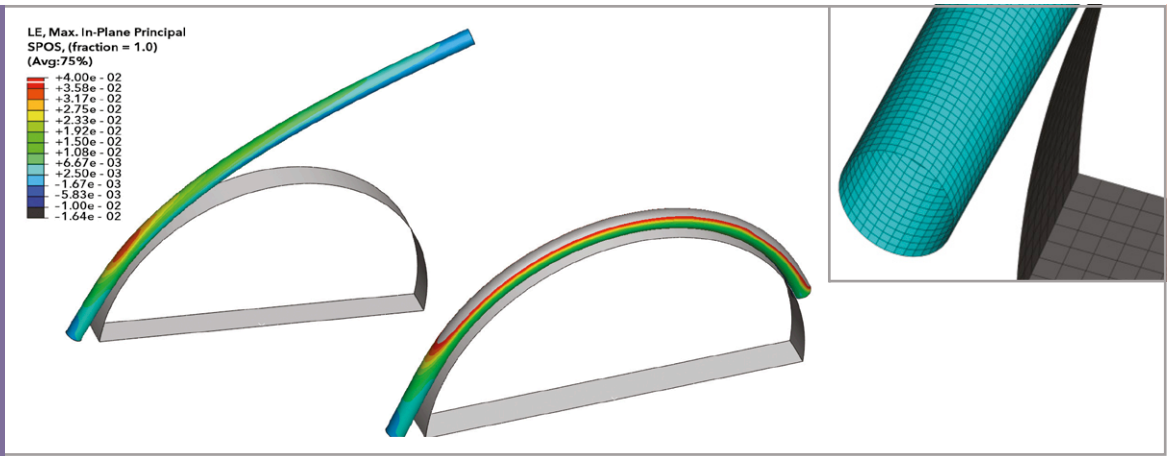
These simulations used the stiffness modulus at 23°C and the complete Solef 1010 'stress-strain' curve in order to evaluate the occurrence of the plasticity phenomenon during coiling.

The simulations showed that – as expected – the maximum principal deformation is greater for the pipe with the smallest wall thickness (SDR17). For both simulated SDRs, the maximum principal deformation is 4-5%. This value is close to the irreversible plastic deformation for this grade of PVDF. In light of this, it was decided to increase the coiling diameter (by using a larger spool) and to use a PVDF grade with a lower stiffness for the physical trials. Of the two suitable grades – Solef 11010 and Solef 60512 – it was decided to use the second.

The homopolymer and copolymer grades selected can be differentiated based on a number of factors, including:

- A flexural modulus that is two times higher for the homopolymer;
- A stress at elastic limit that is about two times higher for the homopolymer;
- An ultimate tensile strength that is about 10 times higher for the copolymer;
- A crystallisation temperature range that is very close to the operating temperatures; and,
- A thermal expansion coefficient that is higher for the copolymer – and very close to that of HDPE.

Based on the digital simulations, a programme of experimental extrusion was carried out at plastic



Solvay used finite element simulations to evaluate the effort needed to coil pipe onto a spool

Source: Solvay

Cables

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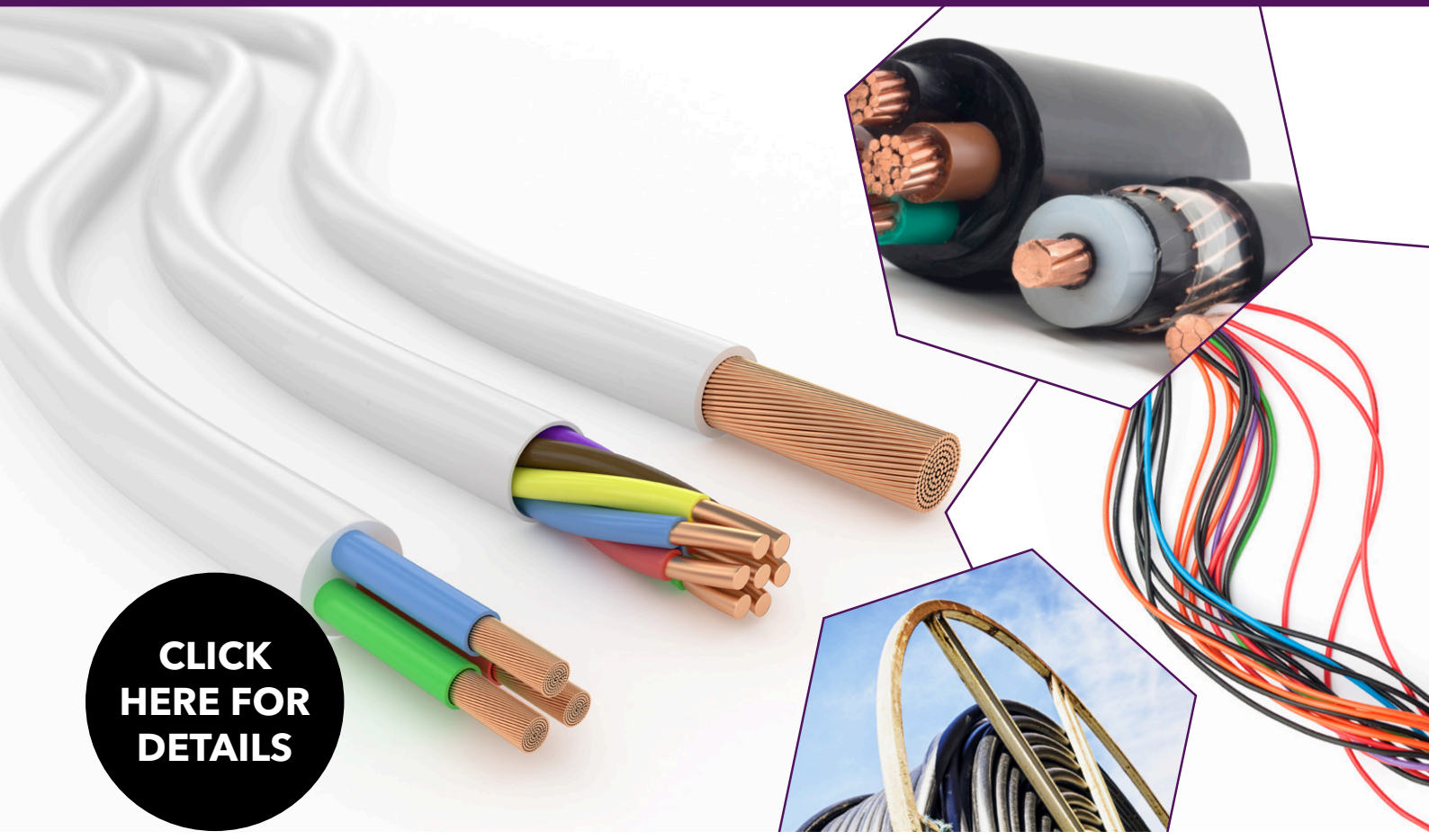

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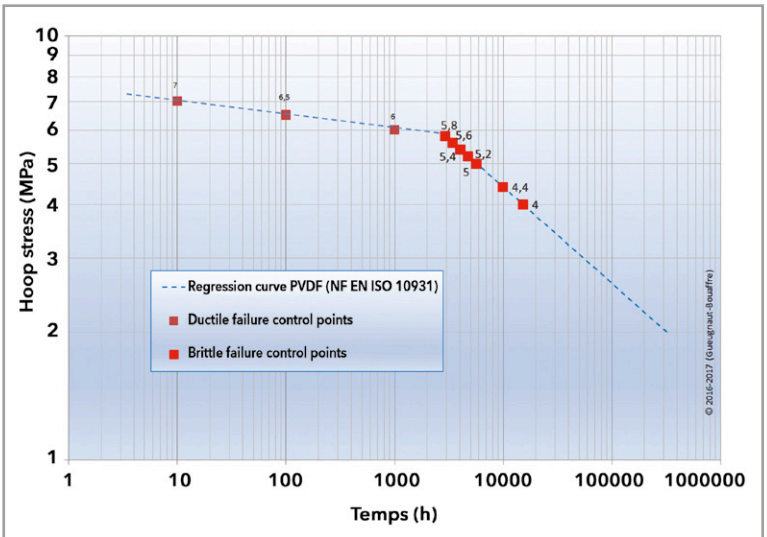

Experimental pressure resistance points to be verified for the Solef 60512 PVDF pipes and welded assemblies

pipe extruder RYB-Elydan in France. The aim was two-fold: firstly, to validate the feasibility of coiling PVDF DN90 SDR11 (thickness of 8.2mm) and SDR17 pipes (thickness 5.4mm) onto a spool; and secondly, to verify the absence of negative impacts arising from the coiling/uncoiling on the long-term mechanical performances of the pipes.

Extrusion and spooling

Given the density and stiffness of the PVDF material compared to that of more conventional polymers, such as PE, a specially designed spool was produced for the experimental campaign.

The target configurations identified beforehand are summarised in the table below:

DN	Thickness	SDR
90	8.2	11
90	5.4	17

The extrusion line was specially prepared in order to extrude the PVDF pipe, including dismantling, cleaning, preparation and tuning. A certain number of preliminary tests were necessary in order to define the operating conditions.

The uncoiling phase was performed following a three-week period of storage on an open-air site. During uncoiling, the temperature measured on the pipe (using an infrared thermometer) was very close to the ambient outdoor temperature of 30-35°C. During this phase, a visual examination was carried out in order to detect potential anomalies such as abnormal deformation and cracking. After uncoiling, the pipe was cut into 1.4m long sections, the length needed to perform pressure resistance tests.

The following observations were made during this phase:

- No anomalies were detected in the behavior of the pipe during uncoiling and cutting;
- There was residual deformation at the extremities over a length of approximately 3m;
- The measured diameter was between 89 and 89.7mm (i.e. very close to the target value of 90mm);
- Average ovalisation was greater on the outermost coil; and,
- The thicknesses were between 6.4 and 7.2mm, which correspond to SDRs of 12-14, so within the interval between the two target SDRs (11 and 17).

These dimension values will be rechecked during the test campaign. The test programme will consist of testing the material, pipes (straight and curved) and welded assemblies (straight and curved components). As regards the pipes and the welded assemblies themselves, pressure resistance testing at 130°C (water within the pipe and air outside) will involve several requirement levels defined on the basis of the standardised regression curves (in accordance with ISO 10931). The objective of the test programme is to relate the experimental points obtained to the ISO 10931 reference.

Conclusions and outlook

The study shows that the coiling and uncoiling of SDR11 and SDR17 DN90 PVDF pipes is achievable under normal industrial conditions. The manufactured pipes should be capable of being coiled and uncoiled without any negative impacts on long-term mechanical performances on the one hand, while the pipes still satisfy the initial requirements of sufficient temperature performance. If the validation is successful, then it remains to verify that the results can be extrapolated to pipes with larger diameters – and at least to DN160 pipes.

Although the cost of PVDF piping is no longer negligible relative to the overall site costs – as is the case with PE pipes, for example – a thorough Opex-Capex study will be required in order to identify the inherent advantages of this material compared to the disadvantages of the traditional steel solution.

■ The co-authors of this article are: Dominique Gueugnaut, Pascal Aussant & Romauld Bouaffre (RICE GRTgaz), Philippe-Jacques Leng, Philippe Martin & Elisabetta Sartirana (Solvay Specialty Polymers) and Marc Palomares (RYB-Groupe Elydan). With acknowledgements to Guy Van Meulebeke (Solvay Specialty Polymers, Belgium) for digital analysis of the coiling of pipes onto spools.

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TiO_2 market remains unsettled

PHOTO: TRONOX

The price fluctuations that have characterised the TiO_2 market in recent years do not seem likely to disappear. **Peter Mapleston** looks at market and product developments

Supply of titanium dioxide (TiO_2) white pigment has in recent years been characterised by price swings that have hampered planning (among other things) on the demand side. It is not clear if that is likely to change in the near future.

Mark Vergnano, CEO of leading producer **Chemours**, says his company is doing its bit to help in terms of price stability by driving significantly more TiO_2 sales under its Value Stabilization (VS) contracts. Customers may not always pay less than if they buy on the spot market or if they have shorter-term contracts, but at least the uncertainty is taken out of the equation, and inventory can be stabilised, is the company's message.

The Chemours VS multi-year TiO_2 contracts allow customers to have flexibility in volumes while maintaining a more stable price. Vergnano says that, in the long run, they should help stabilise the industry. He also says that overall quality of TiO_2 from Chinese suppliers, many of which operate with sulphate technology, will take "many years" to get to chloride levels. Nor does he see much more capacity coming onstream there, noting that, for all applications, around 200,000 tonnes/year of capacity needs to be added annually, just to meet demand growth.

"Today we are back into balance. China has shut down a lot of inefficient capacity, and I don't see any reason China would re-enter with a lot of capacity," Vergnano told one news outlet earlier this year. Plants that were shut down as a result of a government crack-down on pollution are not coming back, he noted. Chemours itself is debottlenecking its TiO_2 plants around the world to add an additional 10% of capacity through 2021 from a year end 2017 base of 1.25m tonnes/year.

Other companies too are on growth paths. **Lomon Billions** is now the largest TiO_2 pigment producer in China and the world's fourth largest, operating both chloride and sulphate plants. Marketing Director Julie Reid, based in Stockton-on-Tees, UK (she was previously with Huntsman) said at Chinaplas last year that Lomon Billions plans to significantly grow its production capacity. "We're aiming to become the global market leader with around 1.3m tonnes of TiO_2 pigment capacity by the mid 2020's," she said. Last year, the company said it would add 200,000 tonnes/yr of chloride capacity with two new lines in Jiaozuo, China. Production is forecast to begin this year.

Back in the West, the merger of two other TiO_2 majors hangs in the balance. In July 2018, the European Commission approved the acquisition of **Cristal** by **Tronox** – first announced in February 2017 – conditional on full compliance with commitments offered by Tronox. Commissioner Margrethe Vestager, in charge of competition

Main image: Structural changes, such as the takeover of Cristal by Tronox that is being challenged in the US, mean TiO_2 markets are likely to remain unsettled for some time

PHOTO: VENATOR

Right: Consumer electronics firms demand the bright whites that can be delivered by Tioxide TR48

policy, said: "Tronox and Cristal are two of the four major players in this market, but we can approve their merger because the companies offered a suitable remedy that fully addresses our competition concerns. This decision will ensure that these products can continue to be offered at competitive prices and without reducing the number of suppliers available for consumers."

The Commission concluded that, while the takeover as initially notified would have significantly reduced competition on the European market for chloride-based TiO_2 pigment for use in paper laminate, there were no competition concerns regarding TiO_2 pigment for use in other products, in particular paints and plastics, since there are many suppliers active in Europe and that "customers can and do use a wider variety of TiO_2 pigment types, including those with a sulphate-based production process."

To address the Commission's competition concerns, Tronox offered to sell its global business in TiO_2 pigment for paper laminate. In mid-July, it submitted to the European Commission definitive agreements with **Venator Materials** to divest its 8120 paper-laminate product grade currently supplied to European customers from a facility in Botlek, The Netherlands.

Tronox has also entered into a binding Memorandum of Understanding with Venator providing for the negotiation of a definitive agreement to sell Cristal's Ashtabula, Ohio, two-plant TiO_2 production complex to Venator if such a divestiture is required to consummate the Cristal acquisition.

Above: Venator claims its Tioxide TR42 pigment is its most durable to date. Applications include PVC profiles

However, the U.S. Federal Trade Commission (FTC) filed a complaint against Tronox on 10 July alleging the acquisition would violate antitrust laws by reducing competition in the North American market for chloride-process TiO_2. Tronox fired back, saying it believes the FTC's allegations are "substantively wrong." That legal argument is yet to be settled.

PHOTO: VENATOR

Brighter whites

Meanwhile, some product development goes on. Venator, for example, (spun off from Huntsman in August 2017) says it is introducing "the next level of pigment performance with two new products for customers that want to create whiter, brighter, more durable plastics."

Venator says its new Tioxide TR42 pigment is its most durable TiO_2 to date. "Engineered for use in the plastics industry, Tioxide TR42 pigment is a blue tone, white product that can be easily integrated into a range of polymers including rigid PVC, ABS and LDPE films," it says. "Designed to boost the durability of the plastics it is integrated into, Tioxide TR42 pigment can be used to help polymer products maintain their integrity for the required timescale, better withstanding weather conditions and seasonal changes."

Typical PVC applications include window and door profiles, siding and cladding systems, decking, railing, pipework and roofline products. In ABS, Tioxide TR42 pigment is said to help maintain the lifetime of automotive components including light coloured interior and exterior parts. "The availability of Tioxide TR42 pigment will also be of interest to plastic film and sheet converters," Venator claims. "Integrated into LDPE films for the agricultural sector, Tioxide TR42 pigment can increase the durability of materials used to package mulch and peat and wrap hay and silage bales."

Venator also highlights its Tioxide TR48, which has a bright white, blue tone. Developed for the masterbatch industry, it can be used, the supplier says, to enhance the appearance of premium ABS plastics and can also be integrated into polyolefin masterbatches and used in the production of multi-layered packaging films and for injection and blow moulding applications, where durability is not

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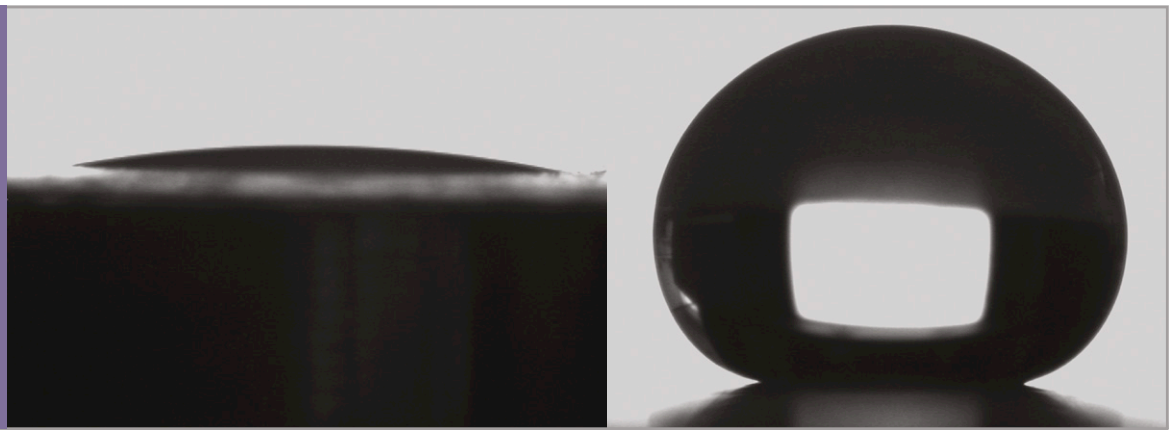

Photos taken with a DSA100 Drop Shape Analyzer show drops of water deposited onto TiO2 particles with hydrophilic (left) and hydrophobic (right) surfaces

Source: RD Titan Group Innovative TiO_2

a primary requirement.

Made in a process that uses selected organic and inorganic treatments, Tioxide TR48 pigment "delivers a range of excellent processing and performance properties," Venator says. In ABS, for example, it can enable the production of brighter, whiter parts with reduced susceptibility to yellowing, even when processed at or exposed to high temperatures. "This feature is a major benefit in the consumer electronics industry where there is high demand for bright, white electronic devices and matching charging accessories including headphones, plugs and sockets," Venator says.

Cutting costs

RD Titan Group Innovative TiO2 has some interesting news, not only for compounders, but for budding TiO_2 producers too. Company co-founder and director Andriy Gonchar says that most TiO_2 grades for plastics are made hydrophobic by surface treatment of the particles using special organic additives. Such hydrophobic treatment provides improved wettability in melts of non-polar polymers, ensures their better dispersion, and also provides the preparation of less viscous mixtures of the molten polymer and the pigment.

The substances used for TiO_2 hydrophobisation can be divided into two types: additives that are physically adsorbed onto the particles surface (polydimethylsiloxanes, for example), or additives which chemically interact with the surface (such as egg, silane, phosphonic acids).

Additives of the first type have one common drawback - during the mixing of the pigment with the polymer melt, they tend to desorb from the surface of TiO_2 particles and migrate, resulting in the effect of a "greasy" surface of the pigmented polymer material. In this regard, the use of the second type additives for TiO_2 hydrophobisation is more preferable, because they don't desorb from surface of TiO_2 particles. Most hydrophobic grades of the world's leading TiO_2 producers are treated with additives of the second type.

Pigment manufacturers can use different methods of applying hydrophobic coatings. RD Titan Group Innovative TiO_2 has developed a "dry" application technology for the production of "Plastics Type 1" grades (designed for maximum processability). The latest development from the company, working with Swiss candle filter manufacturer Dr Mueller, is a "wet" technology that allows treatment of the TiO_2 in an aqueous suspension, after which (using a specially designed candle filter) the thermal exposure necessary for hydrophobisation and simultaneous drying of the pigment to a moisture content of less than 0.2% is performed.

This technology allows effective hydrophobisation for the production of all three types of TiO_2 grades for plastics. Conventional expensive equipment (filter presses and dryers) can be excluded, significantly reducing capital costs compared to traditional techniques. The technology can be easily implemented at plants currently not producing hydrophobic TiO_2 grades.

Below: Hydrophobic TiO_2 discharged from the RD Titan Group process does not wet and floats on water

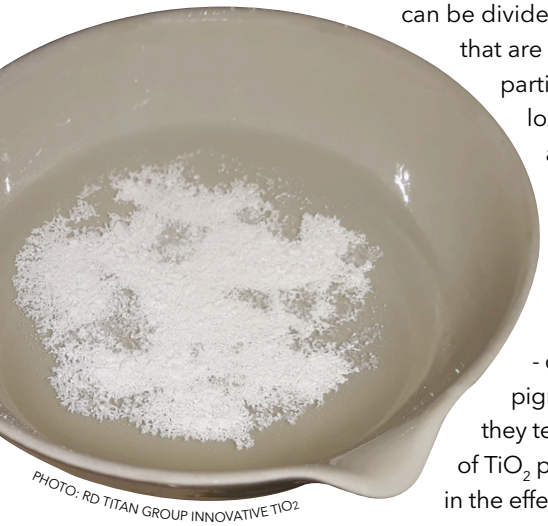

PHOTO: RD TITAN GROUP INNOVATIVE TIO2

Stretching it out

An obvious way for compounders to bring down cost when using TiO_2 is to add less of it. "TiO_2 can be partially replaced using extenders to reduce costs and beneficially, the carbon footprint of the end product," says Tony Bruce, Business Development Manager, Performance Chemicals at **Cornelius**. "We believe TiO_2 extenders, manufactured by our partners VB Technochemicals and Evonik Silica Finland, will always have a part of play in the TiO_2 market due to continuing long term market volatility. Extenders will generally offer a cost saving to a customer's inventory so regardless of a TiO_2 shortage, incorporating them can be win : win

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PHOTO: SHUTTERSTOCK

Above: TDMA is responding to European Commission proposals to list TiO_2 as a suspected carcinogen

for the balance sheet."

At **FP-Pigments**, Group Technical Director Paul Dietz says business with its FP-500 Series (TiO_2 particles coated in calcium carbonate in a 20:80 ratio) continues to grow as customers find they are able to reduce use of TiO_2 use while maintaining end application performance.

"Over the last couple of years we have seen increased interest in FP-550 for masterbatches and FP-510 for PVC (both rigid and flexible) as TiO_2 prices rose and users tried to maintain cost effect performance," he says.

Health concerns

In October 2017, the Risk Assessment Committee (RAC) of the European Chemicals Agency (ECHA) proposed classifying TiO_2 as a suspected carcinogen (Category 2) by inhalation. We asked the **Titanium Dioxide Manufacturers Association** (TDMA), a sector group of the European Chemical Industry Council (CEFIC), to explain how it has responded to the move.

"TDMA stands by its view that TiO_2 is safe and has been engaging with the European Commission, the Member States and other interested parties in regulatory discussions to find an appropriate way to take this opinion forward," according to TDMA. "In November, the European Commission asked the Member States and interested parties whether the RAC's opinion could be included directly into the CLP Regulation [which aligns the EU system of classification, labelling and packaging of chemical substances and mixtures to the Globally Harmonised System, GHS]. TDMA and others have many questions on whether the CLP is the most efficient tool to address the potential hazard described in the RAC's opinion."

The association says that most stakeholders have expressed concerns over a direct inclusion in the CLP Regulation, given the complexity and precedent-setting nature of the case. It says the discussions between stakeholders have confirmed that the potential concern for TiO_2 is predominantly a question of occupational health and safety, so any solution should take this into account and be appropriate.

"This is a complex issue and the RAC itself recognised that there are several open questions. For example, it highlights that there are open questions in the ECHA guidance on the relevance of using rat data generated under conditions of lung overload for humans," the association says. "The RAC also concludes that the hazard described for TiO_2 is not an 'intrinsic toxicity' in a classical sense but is characterised as particle toxicity. This means that the hazards described are not exclusively characteristic for TiO_2 but apply to a whole group of chemicals referred to as 'poorly soluble low toxicity particles' (PSLTs). Therefore, any regulatory decision on TiO_2 would effectively set a precedent for hundreds of other granular dusts."

TDMA has highlighted that the proposed classification for TiO_2 would have unintended impacts in downstream legislation. As an example, if TiO_2 was classified, waste containing more than 1% of TiO_2 would automatically be deemed hazardous under the EU's Waste Framework Directive, rendering waste containing more than 1% TiO_2 unrecyclable, even when there is no potential for inhalation of unbound TiO_2. For instance, it estimates that the cost of managing waste paint buckets in Germany alone would increase from €10m (for recyclable buckets) to €200m (for hazardous buckets).

To answer open questions, the TDMA has launched a €14m science programme and has asked the Commission to wait for outcomes of this programme before a decision is taken, as it would build the scientific basis to help resolve the many issues, without setting aside the RAC's opinion. "The regulatory discussions on TiO_2 continue and TDMA is committed to continue its work with the authorities in this process to find an appropriate solution," the association says.

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- **www.lomonbillions.global**
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- **www.tronox.com**
- **www.venatorcorp.com**
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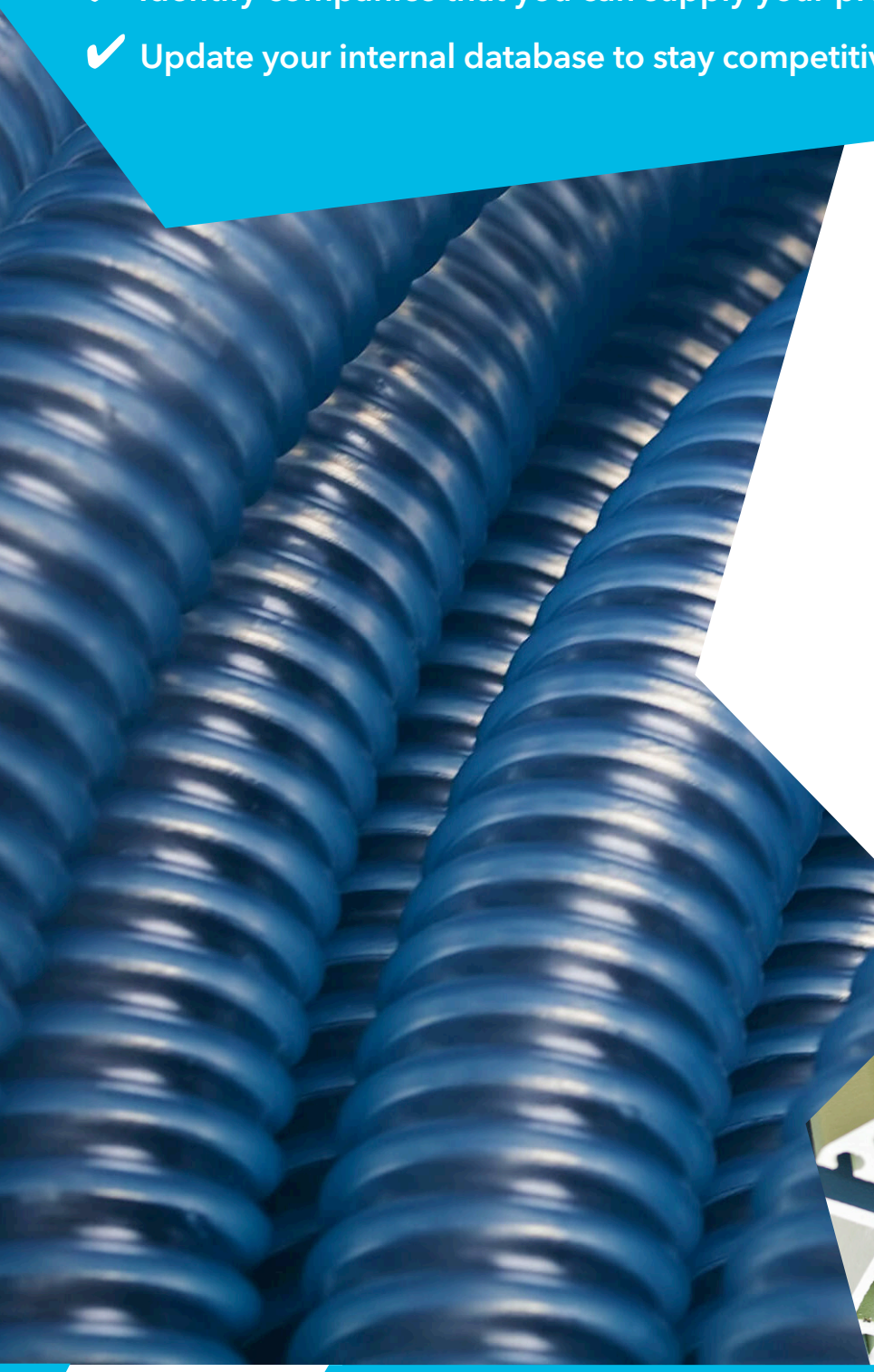

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What makes TiO_2 so special?

Lomon Billions Quality and Technical Manager* Neil MacDonald*, provided a primer on TiO_2 at a recent pigments event, explaining why it is so good at its job. This article summarises his key points

PHOTO: SHUTTERSTOCK

Two allotropes of TiO_2, rutile and anatase, are commercially suitable for use as pigments. This is because they can be manufactured cost effectively, have very high refractive indices (RI), and scatter electromagnetic radiation efficiently - especially in the visible region of the spectrum.

Figure 1 compares the RI of rutile and anatase TiO_2 with other materials that might be considered opacifying pigments. Although some materials have refractive indices approaching those of TiO_2, the optimal combination of high refractive index and ease/cost of production is provided by TiO_2. Figure 2 shows the difference in RI between the two allotropes and a number of common polymers (which determines effective reflectivity).

To deliver opacity efficiently, a pigment must also be present in a well-dispersed particulate form with correct average particle size and narrow particle size distribution. For TiO_2 pigments, the optimal particle size for visible light scattering is about 0.25 microns. Ideally, all TiO_2 particles would be monodisperse with particle size of 0.25 microns. In practice, however, TiO_2 is made with a range of particle sizes centred on the optimal average size.

The amount of oversize pigment particles must be kept to the minimum if a high gloss surface finish is required. "Oversize" in this case means particles greater than about 0.4 microns. The presence of a high proportion of these particles, which can protrude from the surface of a blown film, for example, would make it difficult to obtain a high gloss.

Process effects

TiO_2 is made via two process technologies – Sulphate and Chloride. In the Sulphate Process, ilmenite ore is purified by a sequence of crystallisation, filtration and washing techniques before being calcined to produce crystalline titanium dioxide. In the Chloride Process, pigmentary titanium dioxide pigment with extremely low levels of transition metal impurities is produced. The latter has benefits for the colour of the pigment – Chloride Process pigments generally have a cleaner, more blue tone than Sulphate Process pigments.

The properties of most TiO_2 pigments are further tailored by application of coatings to the surface of the crystals. These coatings prevent compaction of the pigment during storage and transportation, encourage rapid redispersion during compounding, and minimise photochemical activity in its final application.

While the colour of Chloride Process pigments is generally preferred, Chloride TiO_2 rutile pigments are also more abrasive than Sulphate process rutiles. This can have an effect on compounding

Main image: Neil MacDonald explains why TiO_2 is such a powerful addition to the range of plastic pigments

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equipment, reducing the lifetime of extruder screws by wearing the flight tips or increasing the amount of metal pick-up when using a high-speed mixer to prepare a dry-blend or pre-mix (with consequences for colour). In some applications where minimal abrasivity is required, softer anatase pigments can be used.

Although the optimum crystal size for TiO_2 pigments for opacity is about 0.25 microns, TiO_2 pigments made for plastics applications are often intentionally made with a crystal size of 0.20 microns or less because this promotes scattering of blue light and imparts a more aesthetically pleasing "clean, blue" tone to white plastic articles, which can otherwise have a slightly yellow tone.

The properties of the TiO_2 pigment are further modified by the application of coating materials to the surface of the TiO_2 particles, applied dispersed as an aqueous colloid. For pigments intended for use in plastics, alumina only, or silica with alumina (to improve durability) are the most common types of hydrous oxide coatings.

In the final stages of pigment manufacturing, the nature of the pigment surface is modified by application of a surfactant, commonly referred to as the "organic." This is intended to compatibilise the pigment surface with the polymer. Siloxanes are widely used in the production of general-purpose plastics pigments. More recently, reactive C-8 surfactants have been used to make TiO_2 pigments with superior dispersibility. These types of pigments allow users to operate production lines at higher throughput rates, while providing excellent pigmentation of plastics materials.

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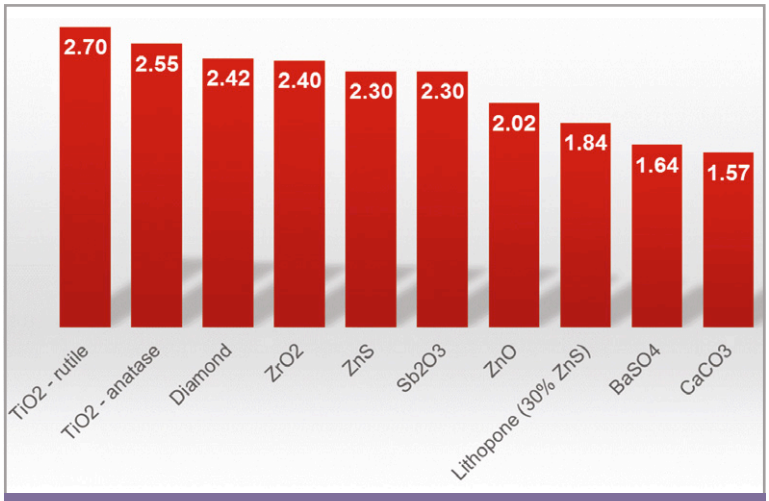

Figure 1: Refractive indices of rutile and anatase TiO_2 compared to other potential white pigments

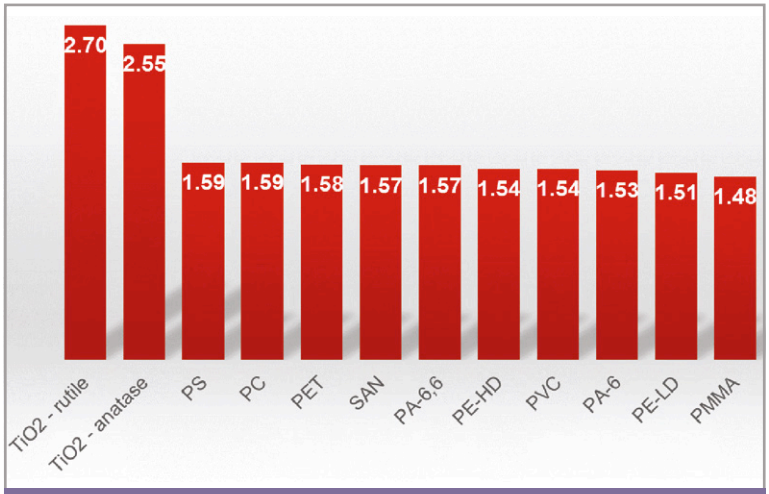

Figure 2: Refractive index of rutile and anatase TiO_2 compared to common thermoplastics. The difference in refractive index between pigment and polymer determines effective reflectivity

Source: Lomon Billions

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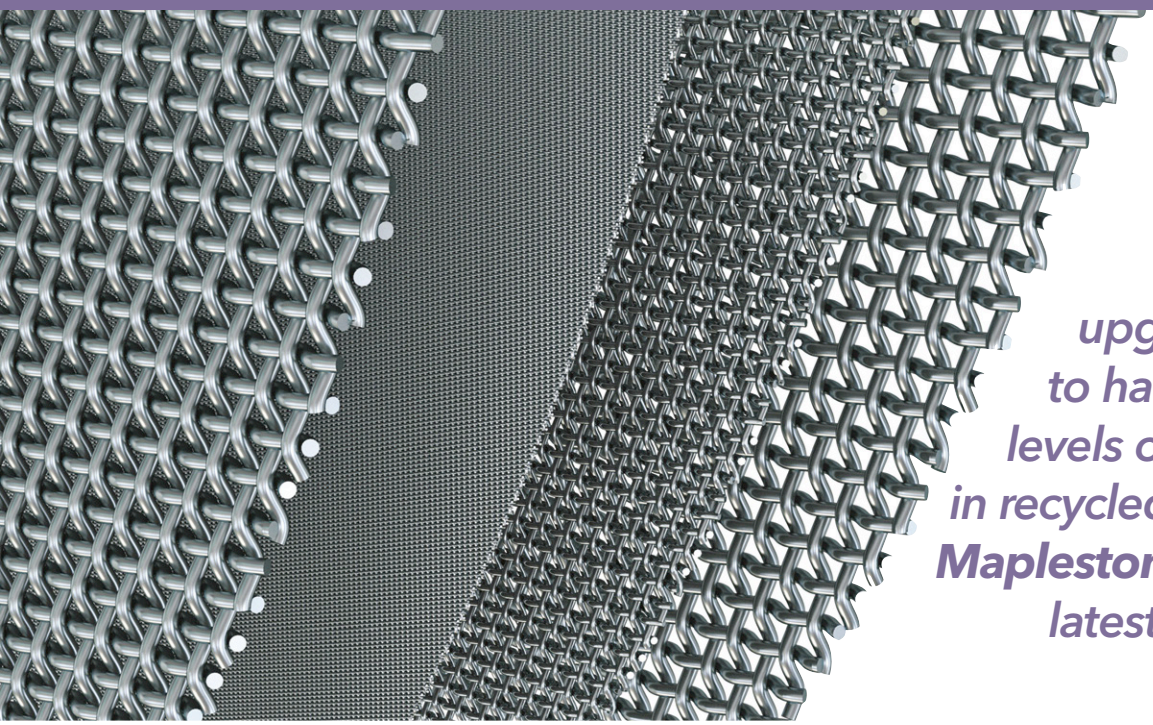


*Melt filter and screenchanger producers are upgrading designs to handle the higher levels of contaminants in recycled plastics. **Peter Mapleston** reports on the latest developments*

Innovations in melt filtration

Suppliers of melt filtration equipment are making steady progress in the development of innovative and more effective solutions for cleaning up industrial and post-consumer plastic melt streams containing levels of contamination all the way to very high. And several of the very latest developments first saw the light of day at two major recent international trade shows – NPE in the US in May and Plast in Italy in May/June).

At Plast, for example, **FIMIC** displayed its ERAmelt filtration system. This filters material twice using meshes of two different sizes enabling it to handle highly contaminated, typically post-consumer, waste plastic. In a typical installation, the first mesh might be 400 micron and the second one 150 micron. Sales Director Erica Canaia explains that with laser-perforated filters being so expensive, the holes in the first filter are typically punched out and only the second filter is laser-perforated. The system is said to provide an interesting and cost-effective alternative to the use of two extruders, each equipped with its own single filter. The Italian company has just installed two of these systems at a customer in Canada.

FIMIC is also placing a lot of emphasis on PVC recycling, especially from cable scrap, and in this sector has been cooperating with researchers from Zlin University in the Czech Republic. Together with a customer, the team has tested a modified version of FIMIC's RAS melt filter, using two different filtration levels of 600 micron and later 300 micron; future tests will use finer filters, down to 200 micron. FIMIC Technician Marco Napoleone says the results to date have been "excellent."

Heavy Duties

Cofit had its new Gorillabelt T automatic and continuous screen changer on display at the Italian show. This is also intended for heavy recycling duties and offers filtration levels to 50 micron and features what the company describes as a zero polymer loss cleaning cycle. Cofit says the T version can handle a wide variety of waste plastics – it highlights building and agricultural film waste in particular, as well as post-consumer materials – containing any type of scrap (metal, wood, paper, textile fibre, sand, and more).

The Gorillabelt T can operate at temperatures up to 300 °C and pressures of up to 300 bar, with

Main image: A common configuration for Nordson's new screen packs is a four-layer arrangement

PHOTO: FIMIC

Left: A PVC filtration test using an RAS melt filter in the FIMIC plant in Italy

PHOTO: PETER MAPLESTON

Right: Changing filters on BD Plast's BDOx3 unit during Plast 2018

output rates up to 3,000 kg/h. Filter area is up to 816 cm^2 and screens are supplied on 50m rolls, each sufficient for up to 250 changes. Cofit says the new unit "is the first step towards an Industry 4.0-ready extrusion project" as, through a special remote assistance module, any process failure can be easily assessed and fixed. Control software can also be quickly updated.

Back flush option

Also at Plast, Italy's **BD Plast** showed its latest continuous screen changer for materials with medium levels of contamination, the BDOx3 BF (the latter initials indicating it is a Back Flush model). It incorporates a novel concept for handling flushing that Dante Boicelli, from the company's commercial department, says is quite different from other machines and which, he claims, has eliminated blockages in the breaker plates. "We have adopted a completely new concept for the construction of the plate holding the filters," he said. Movements are controlled pneumatically.

Filtration standards

The latest melt filter from **Ettlinger** – part of the growing Maag operation since the beginning of this year – "raises throughput to a whole new level for a global customer base," according to the company. The ERF350 is a further development on Ettlinger's ERF250, its most popular model, and was on show at both NPE and Plast.

All filters on the ERF350 are self-cleaning via 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.

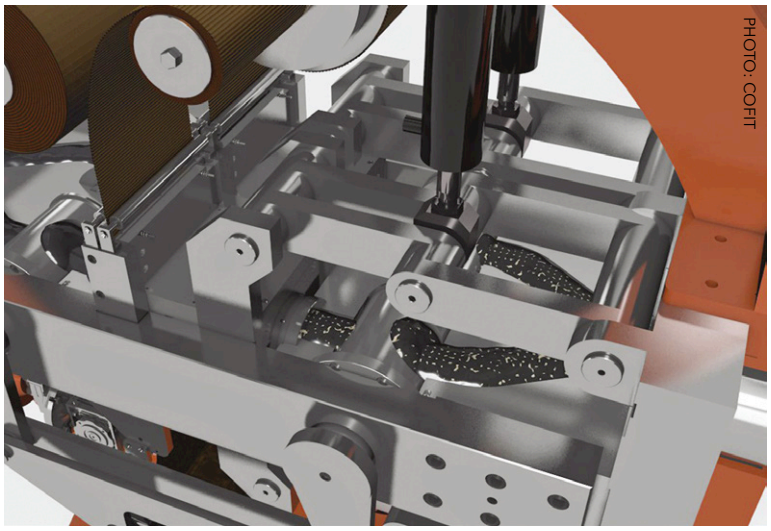


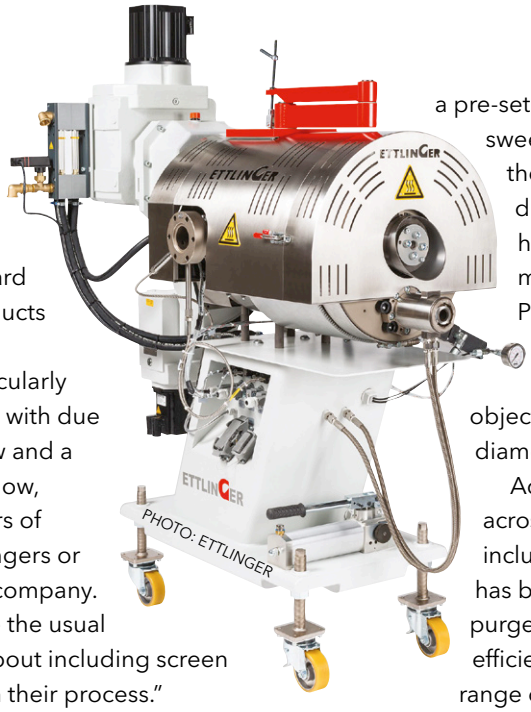
PHOTO: COFIT

Above: This digital image shows shows how contaminated melt is divided into two channels in the Gorillabelt T melt filter, with a system of levers used to close one channel at a time when pressure sensors indicate that a filtration screen has become clogged. Once the channel is closed, clamps holding the roll-fed screen in place open to allow a new section to be moved into place

This arrangement enables the filter to be used fully automatically and without any production disruptions over a period of weeks and months without having to replace the screen. Advantages are said to include ultra-low melt loss and good mixing and homogenising of the melt.

Ettlinger ERF filters are suitable for filtering all standard polyolefins and polystyrenes, as well as numerous engineering plastics such as styrene copolymers, TPE and TPU. Foreign particles can be removed from base materials containing up to 18% contaminants. Depending on the type and level of contamination in the melt and the selected screen size, the ERF350 achieves a maximum throughput of over 3,750 kg/hr. That is around 28% more than the current ERF250 model using the same filtration surface and with the same footprint.

The high filtration capabilities of the Ettlinger melt filter design is one of the factors cited by Austrian recycler Candi in its selection of the company's equipment - an ERF200 model for its plant at Sollenau in Austria and its SC Calex subsidiary at Satu Nou de Jos in Romania. The company reprocesses mostly cosmetics bottles and tubes, dairy and beverage packaging with lid seals, which means it has to deal with silicone and aluminium contaminants at high levels on a continuous basis. "Our customers expect regrind of the highest possible quality from us even though the input material contains extraneous components. We must be capable of removing virtually every single particle of contaminated material," says Candi Managing Director Gheorghe Campan. ›



Left: Ettlinger says its new ERF350 melt filter provides almost 30% higher throughput than its predecessor, the ERF250

Built for hard vinyl

Polymer Systems Inc (PSI) introduced a new screen changer and a new melt pump at NPE developed specifically for processing hard vinyl. Both are PSI's first products of their type for use with this material type. "PVC is a particularly challenging material to work with due to its narrow process window and a need for a constant, steady flow, which keeps many processers of rPVC from using screen changers or gear pumps at all," says the company. "The new products eliminate the usual concerns processors have about including screen changers and gear pumps in their process."

PSI's Expansion Plate Screen Changer (ESC) tolerates temperature swings of more than 8°C. "We solved the chemistry issues relative to heat, flow, and thermal conductivity that make the use of a screen changer with PVC formulations so challenging," says Don Macnamara, General Manager at PSI.

The screen changer requires only a momentary shut down for a screen change, which PSI says eliminates the need for disassembling the die and the high scrap rates that result from that, especially on short runs. "The screen change process itself is expertly engineered as well, with PLC control of expansion spacer bars that separate the body halves from the slide plate between them," the company claims. Once the spent screen has been replaced, the spacer bars contract, bringing the steel body halves back tightly against the slide plate, recreating a seal through direct steel-on-steel contact.

The ESC comes standard with corrosion-resistant stainless-steel components, straight-through chrome plated flow bores to reduce surface friction and eliminate hang-up areas, and identical interchangeable and field repairable upstream and downstream bodies for easy repair or replacement.

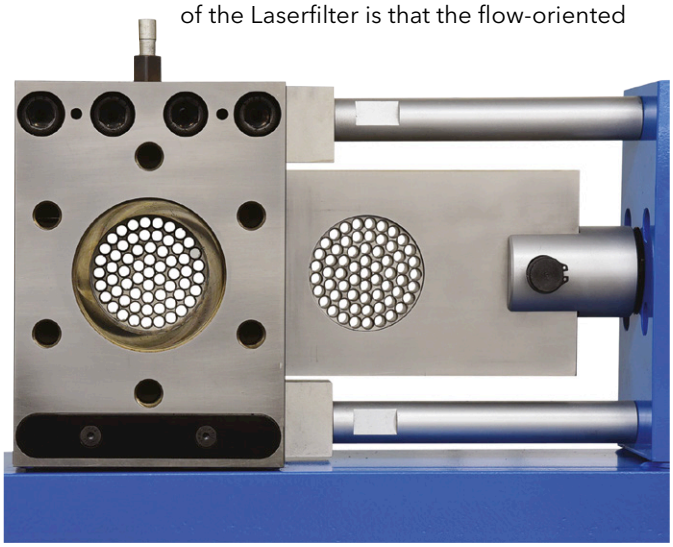
ADG Solutions has a new model in its CFO line of continuous melt filtration systems, the CFO 25. This has a diameter of 25-inches (635mm), allowing throughputs of up to 3,400 kg/h. Aimed squarely at the US market, the CFO 25 has completely imperial sizing. Replacing an existing 24-inch (600mm) model, it is claimed to be fully leak-proof, with the robust design tolerating pressures of up to 3,500 psi.

The CFO unit is fully automatic: when waste builds up and back pressure reaches a pre-set level, a rotating blade sweeps the screen and removes the contamination through a discharge port. The filter can handle a broad range of materials including PE, PP, PS, PC, and ABS. The design will function with up to 10% paper and other foreign objects up to just under 20 mm in diameter.

Advancements now available across the complete CFO line include a new scraper design that has been refined for smaller purges. This is said to improve efficiency and cover a broader range of applications. The screen plate filter has also been redesigned and is now thicker, harder and presents more uniform hole quality. Later this year, a new diamond-hard plate surface will be available for processing aggressive and abrasive materials. ADG says this will offer a screen life extension of 2-3 times longer than the existing design.

From PO to PET...

Erema has been offering its Laserfilter for use in polyolefin recycling systems for more than 20 years. Last year, it launched a modified Laserfilter for PET systems, as well. Robert Obermayr, Head of Erema's Powerfil Business Unit says it has already sold a number of models in the inline sheet, strapping and pelletising sectors. "The convincing arguments definitely include the smooth handling of PET melts with high degrees of contamination which can also be over one per cent, stable pressure consistency and particularly long screen service life," he says. "Another benefit of the Laserfilter is that the flow-oriented



Left: Screenchanger manufacturers are working hard to improve performance of their equipment. This PSI design is optimised for the challenge of rigid PVC processing

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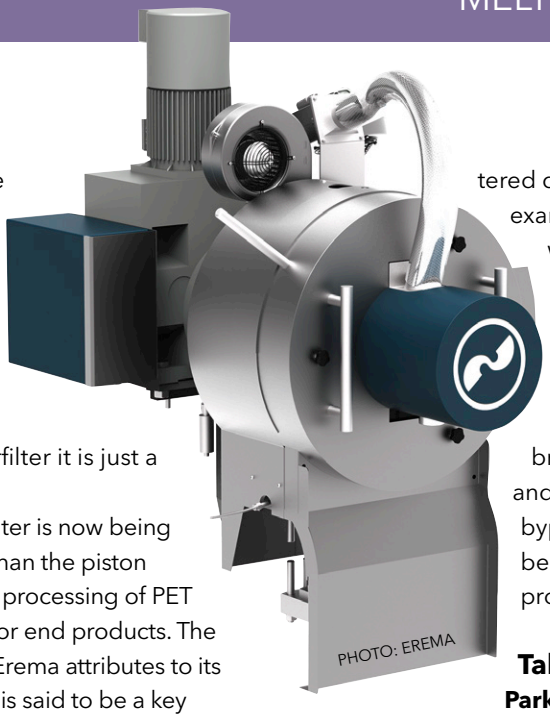
PHOTO: EREMA

Left: Erema now offers Laserfilter models for PET as well as polyolefin processing

working principle avoids the formation of 'black spots'. The user also benefits from the lower melt losses which is achieved thanks to the newly developed discharge unit. Whereas the normal figure for piston filters is 1-2%, with the Laserfilter it is just a fraction of this."

Obermayr says the Laserfilter is now being used more and more rather than the piston filter, particularly in the direct processing of PET flakes to make semi-finished or end products. The high process stability, which Erema attributes to its constant-pressure operation, is said to be a key factor in its selection. The company also says that, while the maximum level of contamination that can be handled by a piston filter lies between 0.05-0.1%, the Laserfilter processes input material with a degree of contamination of more than 1%. This means greater flexibility in being able to handle increasing contaminated in post-consumer input material.

"With the PET Laserfilter we are talking about screen life of five to twelve weeks," Obermayr says. "You mustn't underestimate the fact that the daily screen change by the operator which is necessary with a piston screen changer is no longer required and this reduces the risk of operating error considerably."

Taking the pressure

At the recent Fakuma show, Nordson introduced new screen packs for its BKG screen changers that withstand the pressures of extrusion – providing high filtration and optimum melt flow while ensuring a long working life.

One reason for the enhanced performance of these new screen packs is a robust multi-layer structure that prevents failures caused by the pressure differential – of up to 200 bar – encountered during filtration. One such example is 'screen dimpling', in which the mechanical stress forces screen layers into the holes of the breaker plate that supports the screen in the cavity. This distorts the screen, breaking the peripheral seal and causing contaminants to bypass the screen and become part of the end product.

Right: Nordson installed candle filters to upgrade a BKG POLY melt filter for PET at Köksan in Turkey


PHOTO: NORDSON

Taking on change

Parkinson Technologies has been offering the KCH continuous belt screen changer in its Key Filters range for several years.

Since the 2012 launch of the original KCH, marketing manager Brian Lundgren says Parkinson Technologies has been making refinements as well releasing new options – such as its "spent screen shear" and ScreenLync technology – focused on increasing reliability and efficiency.

"Parkinson saw a growing need in the compounding market for a way to decrease downtime when making a material, grade, or colour change," he says. In such applications, Lundgren says there is a need to limit cross contamination, which in many cases requires replacement of the breaker plate and/or filtration screen.

The result is what he says is an innovative quick-change breaker plate, the KCH-SB. This has been engineered to drastically reduce the amount of time it takes to replace a breaker plate and introduce a fresh clean screen into the process. "The breaker plate's unique design allows rapid change out of the breaker plate in under five minutes, which normally could take up to four hours in downtime," Lundgren says. Without the use of tools, the clean breaker plate is actuated into position while pushing the contaminated breaker plate out of the melt stream.

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- **www.fimic.it**
- **www.cofit.com**
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PHOTO: SHUTTERSTOCK

Pipe infrastructure insights

We preview the latest edition of AMI's Plastic Pipes in Infrastructure conference, which takes place in Dusseldorf, Germany in April

Main image: Plastic infrastructure pipe is booming, at the expense of traditional materials such as clay and concrete

The use of plastic pipe systems in infrastructure projects is on the rise, globally. Safety, reliability, cost effectiveness and sustainability are some of the main reasons why they are gaining credibility over 'traditional' materials, such as metal, clay and concrete.

AMI's *Plastic Pipes in Infrastructure* conference provides a unique networking opportunity and high-level forum for the latest developments and issues in this fast-evolving industry.

The two-day event takes place on 9-10 April 2019 in Dusseldorf, Germany and brings together speakers from the entire supply chain.

Here we preview the event, with a closer look at the line-up of expert speakers.

The opening session provides an in-depth look at solutions to pipeline ageing. **Benjamin Rabaud**, Materials Cluster Manager CIRSEE from **Suez Groupe** starts proceedings with a paper covering the effects of ageing on the integrity of plastic pipes. **Isabelle Berger,** researcher at the **Polymer Competence Center Leoben**, follows up with a presentation on lifetime prediction of polyethylene electrofusion couplings. Completing the session, **Högni Jónsson**, Product Development Manager of **Amiblu Technology**, presents the case for 150 years lifetime of GRP pipes.

Uncovering innovation

After the refreshment break, **Ernst van der Stok,** Consultant Materials from **KIWA Technology**, introduces the second session on material, process and applications innovations, by examining the requirements for PE100 with raised crack resistance (PE100RC). This is followed by **Ralf Glanert,** Technical Account Manager for Infra and Rehabilitation at Wavin, who discusses recent advances in relining technologies. **Aarne Heino,** Managing Director of **Crosslink Finland**, then talks about the novel developments in Pex-A and Pex-B pipe manufacturing processes. **Ralph Handstanger**,

Senior Engineer, Global Segment Pipe & Utilities at **SABIC**, will then share a practical presentation on how to respond to environmental changes through water management. **Keith Mole**, International Business Manager at **McElroy** follows with some case studies on the latest technologies for fusion welding, then **Josef Dobrowsky**, Managing Director of **Conextru** takes the event to the break with a talk about new applications and performances of pipes with die set rotation leads.

Following afternoon tea, **Márton Bredács**, Researcher at **Polymer Competence Center Leoben**, delivers a presentation on models to assess the effect of chlorine dioxide on the lifetime of polyethylene pipe grades. **Dieter Müller,** Sales Manager Pipe Insulation at **Hennecke** then talks about the benefits of pipeline insulation by PU spraying.

The session is concluded by **Miki Burmil** of **Miki Burmil Consulting** talking about plastic manholes to improve infrastructure systems.

Testing times

Delegates will gain comprehensive insights into testing, certification and standardisation during the next session. **Dr Jürgen Wüst**, Deputy Managing Director at **SKZ-Testing**, will talk about an energy and time saving method for qualifying PE Pipe grades for long-term applications at 40°C.

The session continues on the second day of the conference with a presentation on the influence of 'onset' temperature by DSC on U-PVC pipes pressure tests result by **Joaquin Lahoz Castillo**, Plastic Pipes Specialist at **CEIS.** Next, **Christian Kurdy**, Managing Director Middle East & Africa of **NSF International**, shares his expertise on how standardisation for plastic products can protect public health and safety. The final speaker of the session, **Julian West**, Product Manager at **Trelleborg Pipe Seals**, tells delegates about the evolution of elastomeric joints in plastic pipeline systems and the use of long-term stress relaxation testing to predict service life.



Expert speakers at the conference include (left to right): Ralf Glanert, Technical Account Manager for Infra and Rehabilitation at Wavin; Högni Jónsson, Product Development Manager at Amiblu Technology; and Miki Burmil of Miki Burmil Consulting.

Enhancing durability

The next session explores enhancements for pipe durability, and kicks off with a paper from **Simona Africano**, Application Development Technical Service Engineer at **Lyondellbasell**, who discusses ways to advance the PP-RCT performance in water pressure pipes. **Dow Europe** follows next, with a presentation on how raised temperature resistance polyethylene (PE-RT) demonstrates reliable performance in hot and cold applications. **Alfeo Bonato**, Technical Sales Manager at **Bausano**, then shares his views on C-PVC processing. The session ends with **Professor Alessandro Marangoni**, CEO of **Althesys**, discussing how PVC pipes competitiveness should be judged from a total cost of ownership approach.

Quality assured

The final session begins with **Christian Schalich**, Head of Sales, Business Unit Hose & Tube at **Sikora,** on quality control in diameter, ovality, wall thickness and eccentricity during the extrusion of pipes. Closing the conference **Emmeline Aves**, a Polymer Technologist at **Impact Solutions**, will deliver information on quality control and assurance measures in water and gas plastic pipelines to reduce drastic failures upon commissioning.

As well the presentations, the event offers a platform to meet professionals from leading organisations at all levels of the supply chain.

About Plastic Pipes in Infrastructure 2019

Plastic Pipes in Infrastructure provides a high-level forum for the latest developments and issues in this fast-evolving industry. The conference is held at the Intercontinental Hotel in Dusseldorf, Germany, on 9-10 April 2019.

In addition to the formal conference sessions, attendees will benefit from the chance to discuss and network during informal refreshment breaks, and at a drinks reception held at the end of the opening day of the conference.

To find out more about attending the conference, visit the **conference website**, or contact Sophie Roxburgh (**sophie.roxburgh@ami.international**) on +44 (0)117 314 8111.

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PHOTO: MTI

Effective mixing is critical when creating polymer formulations – and mixer suppliers are aiming to provide this with an increasing range of high capacity, flexible systems

Getting the right mix

Within the plastics supply chain, mixers are most commonly used within the compounding sector in the creation of new formulations and compounds. However, extrusion companies that create their own formulations also need to invest in this type of capacity.

For instance, US-based Northern Pipe Products – a major producer of PVC pipe based in Fargo, North Dakota – recently took delivery of a heating/cooling mixer combination Flex-line from **MTI Mischtechnik**.

The M2000/K8000 unit features an 8,000 litre cooling vessel and is over 7m (23ft) long and nearly 5m (16.5ft) high. Installing the system will almost double mixing capacity at the customer's site.

Burkhard Wulf, area sales manager at MTI, said: "We have seen a trend towards increasing production volumes in the US market for some time."

MTI says this is the largest heating/cooling mixer combination it has ever supplied to the USA.

The M2000/K8000 is a heating/cooling mixer combination for a typical batch volume of 950kg (around 2,100lbs). It can provide more than 7,500kg (16,600lbs) of mixed material per hour. Designed on a modular principle, these mixers can be put to use in most applications because their sizes, drive units and equipment options can be individually configured.

Northern Pipe had used an MTI heating/cooling mixer combination – with 1,500 litres of heating mixer and 4,250 litres of cooling mixer capacity – for around 30 years, and even installed a new system as recently as 2014.

"At that time, it was not possible to install a larger system as we had already used the available floor space," said Derek Hanson, vice president of engineering at Northern Pipe.

When delivering the new larger machine, MTI modified its design, building it around the existing steelwork.

"It will overcome a real bottleneck in our plans to expand production capacity," said Hanson.

Designed on a modular principle, the mixers can be put to use in almost any application because their sizes, drive units and equipment options can be individually configured. ›

Main image: MTI has delivered an M2000/K8000 mixing unit to US-based PVC pipe producer Northern Pipe

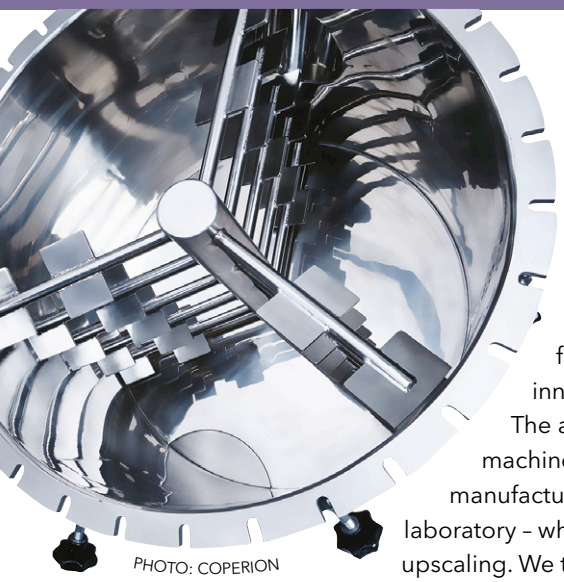

PHOTO: COPERION

Above: Coperion says that its Mix-A-Lot system is in demand as a compact solution that offers lot size and formulation flexibility

Christian Honemeyer, managing director at MTI, added: "The unit specially adapted to Northern Pipe's plant layout clearly reflects our self-concept as a flexible, customer-focused innovator in the mixer industry. The application range of our machines extends from volume manufacturing to the development laboratory – where they support effortless upscaling. We thus cover all typical requirements for batch mixing processes."

Upstream influence

It's true to say that mixers are used more extensively in upstream processes like compounding – during the creation of material grades for different extrusion processes. These have a direct influence over extruded products such as pipes and profiles – and equipment manufacturers are constantly developing continuous and batch mixing solutions that offer versatility in application together with optimal blending and dispersion.

Flexibility in recipe adaption, smaller production cycles and lots, and compact layout are high on the list of requirements for mixers in new compounding and masterbatch plants, says Jürgen Rumschick, sales manager for bulk materials plants, plastics processors and compounders at **Coperion** – which recently introduced its Mix-A-Lot mechanical bulk material mixer.

"As an optional addition, the unit ensures particularly efficient, high speed and gentle homogenisation of the fed material. The readily accessible and easy to clean Mix-A-Lot is available in four sizes for throughput rates up to 5 tonnes/hour. There is also an ATEX version and other options available," he says.

Updated formulations

Right: B&P Littleford's TriVolution is a continuous kneading mixer optimised for flexibility

Another developing trend in the mixing sector is to re-examine and improve processing of formulations that may have been in production for decades.

"Companies are either looking to cut costs by substituting less expensive materials or substitute materials in order to comply with regulatory changes," said Alan Malott, global product manager for continuous mixing systems at US-based **B&P Littleford**. "In addition, there is a demand for increased production while floor space remains limited."

Its mixing equipment products include the TriVolution continuous kneader, which is based on a 60-year-old operating principle that has been updated to meet current processing demands.

"One benefit, compared to previous kneader technology, is its mixing versatility," said Malott.

The segmented elements – which vary from 8-flighted to 24-flighted – are designed to allow quick changeover from low shear to higher shear mixing, based on the formulation being run. This versatility allows operators to switch from low shear, low temperature materials such as PVC, to a highly filled, less shear-sensitive polyolefin, for instance, by switching out the screw elements.

"In addition to the versatile mixing elements, the barrel sections are designed to be modular," he said. "This allows for total re-arrangement of the feed barrels along the length of the shaft. The feed sections were also designed to rotate, allowing a top feed location to become a side feed location easily."

Intensive concepts

The FCM (Farrel Continuous Mixer) from **Farrel Pomini** – for continuous mixing applications – is based on intensive mixing concepts that claim to enable processing efficiency, high versatility, dependability and profitability. Farrel describes the FCM as an independent mixer that is suitable for a wide range of uses – including polyolefins, polystyrene and PVC-based compounds.

The FCM is available in a range of sizes and capacities for applications ranging from pilot/laboratory to large scale production. All models share the same basic mechanical features, operating principles and method to control mixing intensity. Ingredients can be fed into the mixer separately or as a pre-blend, while liquids can be injected directly into the mixing chamber. Intensive material shear is applied to melt the polymer and mix the ingredients by kneading between the

PHOTO: B&P LITTLEFORD

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rotors and chamber wall, as well as by the rolling action within the material itself. The company says features include counter-rotating, non-intermeshing rotors at synchronous speed, giving a large free volume for material circulation and enabling good distributive dispersion by back mixing. The rotor geometry also enables good dispersive mixing.

Modular components make for easy maintenance, while Farrel says the mixer is energy efficient – which helps to control operating costs.

Process specific

Lödige Process Technology of Germany offers both horizontal and vertical mixers that operate either continuously or discontinuously. Specific solutions are offered for processes including mixing, homogenising, dispersing, compounding, heating/cooling and melting – and include the Ploughshare mixer (continuous and batch), continuous CoriMix CM ringlayer mixer, and NOHK wet mixer.

Both the continuous and batch Ploughshare mixers operate on the mechanical generated fluid bed principle. Lödige says its Ploughshare batch mixer offers high quality mixes in short mixing times. Ploughs rotate on the mixer shaft in a horizontal, cylindrical drum, with the size, number, positioning, geometric shape and peripheral speed coordinated to produce three-dimensional movement of the components. The resultant turbulence prevents dead-spots or low-movement zones in the mixing drum and ensures high speed, precision mixing.

Lödige says that to prevent particles being squashed against the drum wall, mixing elements are shaped to lift product within the radial movement of the mix. In some cases, extra assistance for the mixing elements is required – and separately driven, high-speed choppers can be installed to disperse agglomerations or control granulation.

PHOTO: PLAS MEC

Right:At Plast, Plas Mec showed two flagship machines – the Combimix-HC and TRR container mixer

Cool operators

Plas Mec, of Italy showed two flagship machines at last year's Plast show: the Combimix-HC mixing system and the TRR container mixer. The first, used mainly for PVC dryblends, comprises a TRM heating mixer and an HEC cooling mixer. The TRR container mixer is a multipurpose unit for applications where production changes are frequent and easy cleaning is very important .

Commercial director Massimo Grigolon says Plas Mec has increased its focus in recent years on efficiency, productivity and safe operation. He cites an improved water circuit design with enhanced cooling capacity on the HEC cooling mixer, as well as its new jacket that can withstand a working pressure up to 2.5 bar, typically found in factory closed circuit chillers.

"With the Combimix-HC, it is now a straightforward task to cool more than eight batches per hour of U-PVC dryblend from 120°C to 40°C," he said.

At the same event, Italian mixing equipment specialist **Promixon** showed some of the machine elements at the heart of its plants: large blades for a horizontal cooling mixer; and a 2000-L vertical tank with blades for four-stage powder mixing.

The tank on display was fitted with two outlets, enabling it to feed two cooling mixers placed on opposite sides. The company, founded in 2013, has many staff with long histories in the mixing business. It has new offices in Magnago, near Milan, and says it is expanding its team.

PHOTO: PROMIXON

Right: Mixing specialist Promixon showed a set of large blades for a horizontal cooling mixer during Plast

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- **www.mti-mixer.de**
- **www.coperion.com**
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AMI's Polymers for Oil & Gas Engineering conference will explore the use and benefits of high performance polymers in oil and gas applications in the Asia Pacific region

Asia Pacific perspective on oil & gas polymers

Main image: Kuala Lumpur hosts AMI's first Polymers in Oil & Gas Engineering conference, which focuses on the fast developing Asia Pacific oil & gas market

Asia Pacific demand for oil & gas continues to rise. At the same time, countries in the region are looking to upscale their productivity in oil and gas extraction and are keen to explore ways to optimise profitability and enhance the performance of their assets. Polymers for Oil & Gas Engineering is a new conference that will provide an international learning opportunity for companies looking to make use of new and innovative polymer materials.

Taking place on 27-28 March 2019 in Kuala Lumpur, the two-day conference will provide attendees with a focused understanding of the use and benefits of high performance polymers in oil & gas applications. This article previews some of the expert speakers sharing insight at the event.

The first day of the conference will commence with a review of the oil and gas industry delivered by **Neil Mendes**, CEO at **Alpine Polytech** in the US. This will include an overview of the industry for 2019 and how that will affect the polymer market. Next up is **Harizal Abd Rahman,** Senior Executive – Materials, Corrosion and Inspection Engineering at **Petroliam Nasional Berhad (Petronas**) in Malaysia, who will share some practical insight on bringing thermoplastics from the surface to downhole applications. He will be followed by **Flavian Gathier**, EOR Project Director at **SNF** in France, who will review polymer CEOR developments and present some case studies from around the world.

The challenges of using polymers to improve recovery in complex oil field applications will be covered by **Dr Raj Deo Tewari**, Custodian RE at **Petroliam Nasional Berhad (Petronas)** in Malaysia. **David A Seiler**, Senior Business Manager Industrial and Global Advisor Fluoropolymers at **Arkema** in the US, will deliver an examination of high performance polymers for oil & gas engineering applications. Then **Dr Geoff Small**, Technology Manager Energy at **Victrex**, will explain why some PAEK polymers are more chemically resistant than others and what this means in practice. ›

Silvia Torrado, Business Development Manager at **Evonik Resource Efficiency** in Germany, will detail some performance polymer solutions for gas supply and sealing components exposed to challenging conditions. And **KH Lou**, Application Marketing Manager at **Borouge** in Singapore, will explain how new generation polyolefin materials may be able to expand the operational envelope in oil & gas applications.

The conference will then move on to discuss the use of polymers in offshore flexible piping systems. **Dr Wenda Chen**, Head of Business Development Technical Polymers at **Arkema** in Singapore, will present a polymeric perspective while **Nick Owens**, Engineering and Sales Manager Asia Pacific at **NOV Fiber Glass Systems** in Australia, will share some insight into the use and performance benefits of glass fibre reinforced pipe in the oil & gas industry.

The final session of the first day will explore coating and sealing solutions. **Sachin Joshi**, Director at **SK Formulations India**, will deliver a presentation on polymer coating formulation and application to provide corrosion protection. **Daniel L Hertz III**, President at **Seals Eastern** in the US, will discuss elastomer seal considerations for the oilfield.

The second day of Polymers for Oil & Gas Engineering will look at materials and testing. **Tri Wiatno**, Material Control Engineer, and **Dr rer nat Mardiyati**, Researcher and Lecturer, both based at **Bandung Institute of Technology and Science** in Indonesia, will look at various polymer materials characterisation techniques for oil and gas applications. Then **Dr Michail Kalloudis**, Technical Manager at **Impact Solutions** in the UK, will discuss lifetime assessment of thermoplastic pipe liners used in oil & gas applications.

John R Wright Jr, President at **Specialty RTP** in the US, will talk about key considerations operators must take on board when selecting materials for reinforced thermoplastic pipe and tubing (RTP) for severe oilfield environments. And **Ken Yang**, Area Development Manager GTC-SEA at **Solvay Speciality Polymers** in China, will discuss some of the latest polymer application developments in upstream wells.

Key speakers at Polymers for Oil & Gas Engineering 2019 in Malaysia include (top row from left) Alpine Polytech CEO Neil Mendes, Petronas Materials Corrosion and Inspection Senior Executive Harizal Abd Rahman, SNF EOR Project Director Flavian Gathier, Petronas Custodian RE Dr Raj Deo Tewari, (bottom row from left) Borouge Application Marketing Manager KH Lou, Arkema Head of Business Development Dr Wenda Chen, NOV Fiber Glass Systems Asia Pacific Engineering and Sales Manager Nick Owens, and Invention Capital Technology Analyst Anuradha Akella

The final session of the conference will look at requirements for testing and analysis. **Dr Shashi B Kumar**, Principal Consultant at **DNV GL Singapore,** will provide a detailed overview of key design and testing requirements for flexible thermoplastic composite pipes (TCPs) for offshore applications. Then **Anuradha Akella**, Technology Analyst at **Invention Capital** in Singapore, will detail SP formulations for EOR application.

Polymers for Oil & Gas Engineering 2019

Taking place in Kuala Lumpur in Malaysia on 27-28 March 2019, the first Polymers in Oil & Gas Engineering conference brings together leading global experts to identify, share and discuss innovations and developments in the application of polymers in oil & gas industry engineering.

The event will bring together oil industry engineers, materials and polymer engineers, service providers and oilfield operators to examine the latest options for polymer application in onshore and offshore oilfields. Presentations will cover specification and testing, polymer selection and performance, and component design and lifetime prediction. In addition to the formal two-day programme of expert presentations, Polymers for Oil & Gas Engineering will also provide attendees with a highly effective platform from which to meet and network with professionals from leading companies and organisations across the oil & gas industry supply chain.

To learn more, visit the **conference website** or contact Conference Organiser Harriet White. Tel: +44 (0) 117 314 8111; Email: **harriet.white@ami.international**

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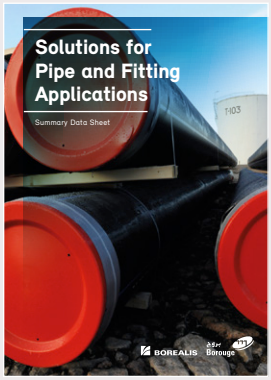
BOREALIS: PIPE POLYMERS



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

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SICA: DOWNSTREAM EQUIPMENT

This brochure from Sica covers the company's wide range of downstream equipment for plastic pipe production. It includes haul-off devices, saws, cutting systems and belling machines.

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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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HEXPOL: DRYFLEX TPE

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

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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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DAVIS-STANDARD: PIPE & PROFILE

Davis-Standard supplies a wide range of extruders and extrusion systems for pipe, profile and tubing applications, including medical tubing. This four page brochure details the range of equipment available and key performance benefits.

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

Learn more about AMI's upcoming conferences

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

PIPELINE COATING EUROPE 2019

AMI's 11th Pipeline Coating conference returns to Vienna in Austria on 12-14 February 2019. This high level international event examines the very latest developments in pipe coating materials and application technology.

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PVC FORMULATION USA 2019

Taking place in Pittsburgh, PA, USA, on 26-27 February 2019, AMI's second North American PVC Formulation conference looks at the latest PVC market trends, material innovations and mixing technology.

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CABLES 2019

Taking place in Dusseldorf in Germany on 5-7 March 2019, AMI's 19th Cables conference will explore the key commercial and technical innovations in polymer-based materials for cable industry applications.

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PLASTICS REGULATIONS 2019

Taking place on 6-7 March 2019 in Düsseldorf, Germany, the third European edition of Plastics Regulations will consider how to respond to new and future regulatory developments that will impact on the plastics supply chain.

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PVC FORMULATION EUROPE

Taking place in Cologne in Germany on 1-3 April, PVC Formulation will discuss global market trends in the PVC industry and explore the latest developments in rigid and flexible PVC materials, plasticisers, additives and compounding.

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PLASTIC PIPES IN INFRASTRUCTURE 2019

Taking place in Dusseldorf in Germany on 9-10 April 2019, AMI's Plastic Pipes in Infrastructure conference is the meeting place for pipe specifiers, installers, end users, resin suppliers, additive producers and equipment makers.

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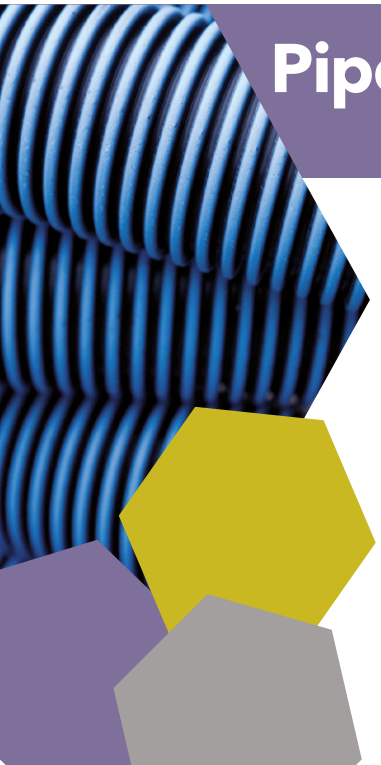
Vision Extrusion

Head office:	Woodbridge, Ontario, Canada
CEO:	Vic De Zen
Founded:	2008
Ownership:	Private
Employees:	More than 1,000
Profile:	Vision Extrusion, founded in 2008, specialises in PVC building products such as window profiles and outdoor fencing. Despite the company's relative youth, founder Vic De Zen has industry experience stretching back 50 years – having earlier founded (and sold) Royal Group Technologies.
Product lines:	Vision Extrusion is one of several linked companies, and focuses on mainly window profiles. The group also makes PVC doors (under its Sunview Patio brand), outdoor PVC products such as fencing, decking, columns and railing in a variety of colours and styles, and even PVC sheds. Vision Extrusion offers all the operations associated with profile extrusion – including tool and die design and manufacturing, raw material compounding and downstream engineering and processing. In addition, the company produces a range of products in steel and aluminium, including doors and frames.
Factory location:	The company is based in Woodbridge, Ontario where it has nine production facilities – making its range of products from windows and doors to fencing and decking. Across the plants, it says it runs more than 200 extrusion lines. In 2018, the company received $1.5m from the Ontario government to invest in new technologies and machinery – which is expected to create more than 75 new jobs. Overall, the upgrades are expected to cost more than $18m, and are due to be completed by the end of 2022.

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 2018
Screws/barrels
Polyolefin developments
Computer modelling software
Laboratory extruders

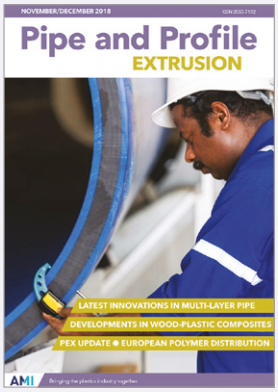
April 2019
Control & Instrumentation
PE100+ • Standards & Testing
Materials recovery & granulators
Plastics Extrusion World Expo preview

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

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

Keep informed: read our latest editions

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



Pipe and Profile
November/December 2018
The November/December edition of Pipe and Profile Extrusion features the latest multilayer pipe dies which can make products more flexibly and efficiently. Plus features on PEX and wood-plastic composites.

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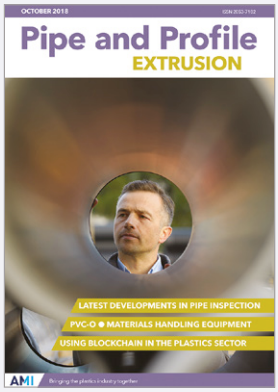

Pipe and Profile
October 2018
The October edition of Pipe and Profile Extrusion magazine has features taking an in-depth look at pipe inspection, oriented PVC, advances in materials handling and new methods for in situ pipe production. The edition also previews AMI's Conductive Plastics conference.

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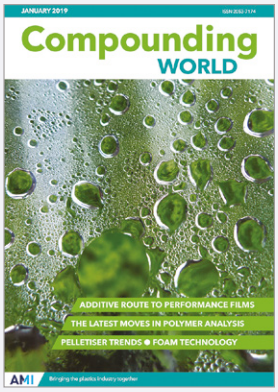

Compounding World
January 2019
The January 2019 edition of Compounding World magazine takes a close-up look at additives for film production. It also reviews developments in pelletising technology, polymer analysis and polymer foaming.

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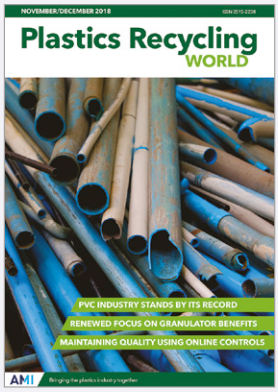

Plastics Recycling World
November/December 2018
The November/December 2018 edition of Plastics Recycling World takes a look at the PVC industry's progress in recycling in Europe and Australia. It also reviews the latest developments in process control and plastic granulation.

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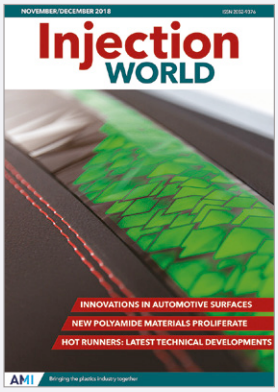

Injection World
November/December 2018
The November/December edition of Injection World magazine reviews the latest innovations in automotive surface decoration. It also takes a look at developments in hot runner technology and polyamide compounds.

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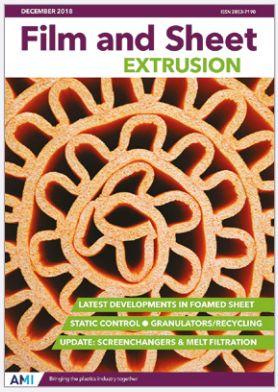

Film and Sheet
December 2018
The December edition of Film and Sheet Extrusion magazine reviews the latest developments in foamed sheet technology. It also details innovations in melt filtration, granulation and static management.

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Plastics Recycling WORLD

GLOBAL EXHIBITION GUIDE

2019	**28 February - 4 March**	Indiaplast, Delhi	www.indiaplast.org
	12-14 March	JEC World, Paris, France	www.jeccomposites.com
	12-16 March	Koplas, Seoul, South Korea	www.koplas.com
	19-21 March	EU Coatings Show, Nuremberg, Germany	www.european-coatings-show.com
	25-29 March	Plástico Brasil, São Paulo, Brazil	www.plasticobrasil.com.br
	8-12 April	Feiplastic, Sao Paulo, Brazil	www.feiplastic.com.br
	8-9 May	Extrusion Expo, Cleveland, USA	www.extrusion-expo.com
	21-24 May	Chinaplas, Guangzhou, China	www.chinaplasonline.com
	21-24 May	Moulding Expo, Stuttgart, Germany	www.moulding-expo.com
	18-21 September	T-Plas/Tiprex, Bangkok, Thailand	www.tplas.com
	16-23 October	K2019, Dusseldorf, Germany	www.k-online.com
	25-28 November	Plastivision Arabia, Sharjah	www.plastivision.ae
	27-29 November	Plastics & Rubber Vietnam	www.plasticsvietnam.com
2020	**16-20 January**	Plastivision India, Mumbai, India	www.plastivision.org
	21-23 January	Swiss Plastics, Lucerne, Switzerland	www.swissplastics-expo.ch
	13-17 October	Fakuma, Friedrichshafen, Germany	www.fakuma-messe.de

AMI CONFERENCES

26-27 February 2019	PVC Formulation, Pittsburgh, USA
27-28 March 2019	Polymers for Oil & Gas Engineering, Kuala Lumpur
1-3 April 2019	PVC Formulation, Cologne, Germany
9-10 April 2019	Plastic Pipes in Infrastructure, Dusseldorf, Germany
4-5 June 2019	Profiles, Pittsburgh, USA
25-26 June 2019	Medical Tubing, Berlin, Germany

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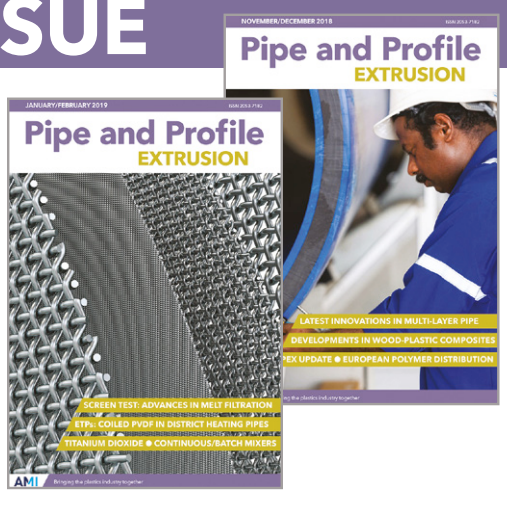

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