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# Sirmax moves in recycling

Italian compounder Sirmax has acquired Società Europea di Regenerazione (SER), a plastics waste recycling specialist based at Salsomaggiore Terme in Parma. The move is the company's first acquisition in the recycling sector.

SER generated sales of around €15m in 2017 and currently has the capacity to recycle around 20,000 tonnes of plastic waste annually. The business was founded in 1989 by Michele Robbe, who will continue to run the operation under Sirmax's ownership.

Sirmax already produces compounds containing all or part recycled resin. Company CEO Massimo Pavin

said the SER acquisition is the next step in its strategy of developing sustainable material options. In particular, he said it will allow it to characterise and develop "green" technical compounds based on post-consumer and post-industrial resins for its global customer base.

"We have identified a partner of absolute competence and specialisation," said Pavin. "In the next few months we will complete the entry into the circular economy with the green-field construction of a 'twin' plant for SER in the United States, with a start-up scheduled for January 2020, so as to

serve our major customers globally also with these new products."

Sirmax, which generated sales of around €300m last year and is forecasting a 2019 result of €385m, is the largest non-integrated plastics compounder in Europe. In addition to its four plants in Italy, it also operates production units in Brazil, India, Poland and the US and plans investments of more than €80m to double its turnover over the next three years.

Projects already underway include the installation of its first TPE/TPV production capacity at Kutno in Poland. [www.sirmax.com](http://www.sirmax.com)

## Cytec files patent suit in China

Solvay's wholly-owned subsidiary, Cytec Industries, and its Polymer Additives business unit have filed a patent infringement lawsuit in the Beijing IP court against Beijing Tiangang Auxiliary.

The action alleges that the Beijing Tiangang Auxiliary's Tiangang T-68 light stabiliser violates a patent covering Solvay's flagship product line, Cyasorb THT, and seeks payment of fees and damages.

Solvay said that the infringement has been verified by independent laboratory analysis. The company said it had approached Tiangang several months ago to resolve the matter but it had "refused to engage in a substantive dialogue".

[www.solvay.com](http://www.solvay.com)

## Americhem adds medical options

Americhem has extended its high performance medical compound options by taking a licence to produce certain custom compound products from Solvay.

The deal means the company will be able to offer pre-coloured and filled grades of Amodel PPA, AvaSpire PAEK, Radel PPSU, Udel PSU Resin and Xydar LCP. All are high-performance resins with uses in high impact, moisture and heat resistant applications requiring good compatibility with disinfectant and sterilisation methods.

End-use applications

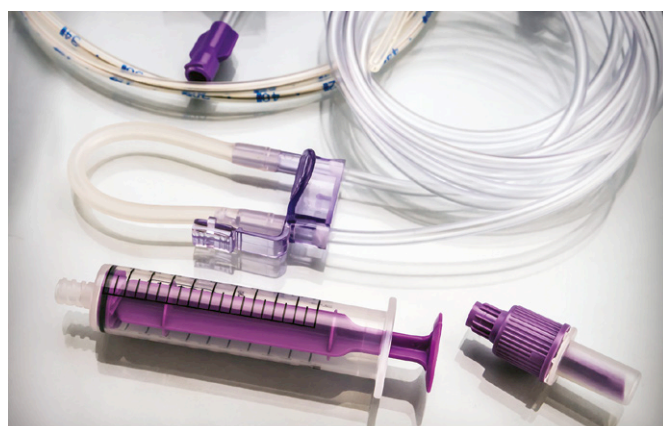


PHOTO: AMERICHEM

include housings, testing equipment and components, orthopaedics, sterilisation cases and trays, and single-use or re-usable devices and instruments.

"We're excited to build

upon our longstanding relationship with Solvay," said Jim Figaniak, Vice President & General Manager of Americhem Engineered Compounds.

[www.americhem.com](http://www.americhem.com)

## One Rock buys Nexeo Plastics

Univar has agreed to sell the plastics distribution business of Nexeo Solutions to private equity firm One Rock Capital Partners in a deal that is expected to close within 1H 2019.

Nexeo Plastics distributes plastic products, including engineering resins, to multiple end-use industries in more than 60

countries across North America, Europe and Asia. One Rock managing partner Tony Lee said that the new owner plans to "create a stand-alone plastics distribution business and invest in growth by deepening its relationships with customers and supplier partners".

[www.onerockcapital.com](http://www.onerockcapital.com)

# Fraud charges against two Lucent executives

Two former senior executives of technical compounding firm Lucent Polymers have been **indicted** on charges of fraud by the Department of Justice US Attorney's Office for the Southern District of Indiana.

Kevin Kuhnash and Jason Jimerson, formerly CEO and COO of the company, are alleged to have concealed critical defects in the Lucent Polymers' business when it was sold to Citadel Plastics in 2013. Citadel was acquired by A Schulman in 2015, which flagged up quality reporting issues within some of the former Lucent operations in 2016 (A Schulman was itself acquired by LyondellBasell in 2018).

According to the indictment, Lucent's internal

testing allegedly showed that its products often did not meet its customers' specifications or UL certification standards. Employees are said to have "created and submitted false records to customers stating that the internal testing confirmed that the products were within spec."

The indictment alleges that Kuhnash and Jimerson did not take meaningful steps to stop the alleged fraud and did not disclose its existence to the acquiring company.

A statement issued by the US Attorney's Office alleges that the two executives received approximately \$2m from the two acquisitions of the Lucent business - first by Citadel and subsequently

by A Schulman. The charges against them carry sentences of up to 20 years.

"Corporate officials who put deviousness over good faith degrade the integrity of our markets and impugn the reputation of American industry," said US Attorney Josh J Minkler. "This office will continue to prioritise the investigation and prosecution of corrupt corporate executives who enrich themselves through fraud and deception."

A Schulman, which discovered the alleged irregularities, took action against Citadel's private equity owner HGGC in 2016. According to the New York Post, a settlement valued at around \$100m was agreed late last year.

## Ampacet presents Cell-Struct

Ampacet has launched its new Cell-Struct line of special effect masterbatches, which, it claims, "visually interprets today's intersection of technology and organic elements in an engaging dimensional look for rigid packaging".

The Cell-Struct line features six colours: Basal Blue, Genome Green, Golden Golgi, Receptor Red, Synaptic Silver and Telomere Teal. All are intended for blowmoulded applications, such as personal care, home and household products of all kinds, and are suitable for



multi-layer processing.

"Although the surface remains smooth, Cell-Struct produces a visually intriguing three-dimensional texture resembling cellular structures," said Elise Fenwick, Insight and

Innovation Manager Americas. "The integration of special effects and technology combines to provide an aesthetic with natural elements for an unexpected juxtaposition."

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

## NEWS IN BRIEF...

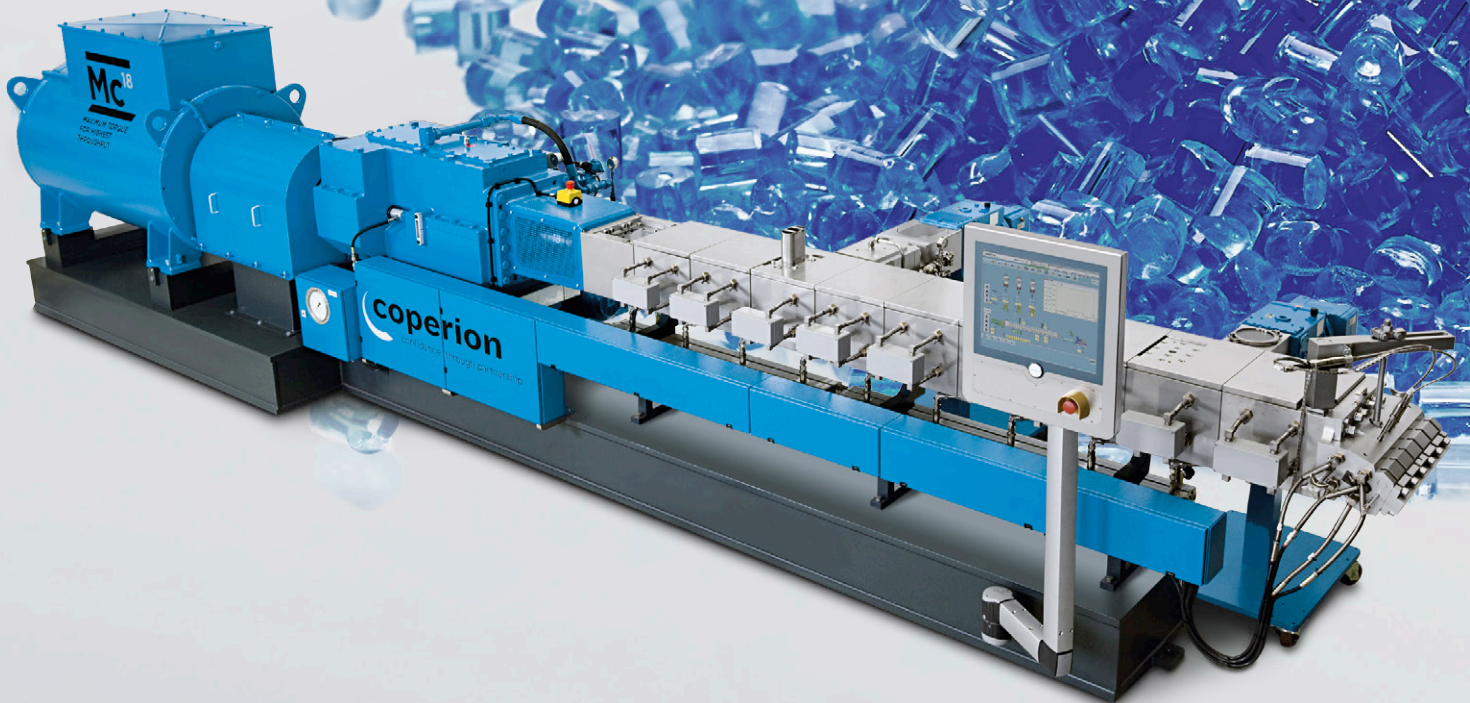
**Albis Plastic** has been appointed exclusive distributor for **Eastman Chemical's** copolyester products in France and Poland (it already has distribution arrangements with the company in Germany, Scandinavia and the UK). The deal includes the Glass Polymer and Tritan product ranges.  
[www.albis.com](http://www.albis.com)  
[www.eastman.com](http://www.eastman.com)

South Korean firm **Songwon** claims to be one of the first chemical companies in the world to package its products in 20 kg bags made with 50% recycled PE. The bags have been trialled over the past year with customers and their use will be further rolled out in the coming months. Songwon collaborated with German packaging specialist RPC BPI Nordfolien to develop the bags.  
[www.songwon.com](http://www.songwon.com)

The European Commission has granted conditional clearance for **BASF** to acquire **Solvay's** PA business after BASF agreed to divest certain manufacturing assets and innovation capabilities in Europe to a third party. The PA businesses being acquired in the Americas and Asia are not affected by the EC decision. The acquisition plan was first announced by BASF and Solvay in 2017.  
[www.basf.com](http://www.basf.com)  
[www.solvay.com](http://www.solvay.com)

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## Total take over at Synova

Total has acquired Synova, a French supplier of 20,000 tonnes/year of recycled PP for the automotive sector that is based at Tillières sur Avre in Normandy. Terms were not disclosed.

According to Total, the material Synova produces meets the highest quality standards of OEMs and automakers for recycled plastics. "Combining Synova's recycling expertise and Total's polymers know-how will increase the supply of recycled PP for automotive applications that deliver the same performance as virgin polymers," it said.

Total is also part of a project aiming to establish a large-scale PS recycling system in France by 2020, for which feasibility will be validated at two of its sites, and co-owns the Total Corbion PLA joint venture in bioplastics in Thailand.

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

## Reagens and Indofil in additives joint venture

Reagens, an Italian-based global supplier of additives for thermoplastics, has set up a joint venture in plastics additives with Indian specialty chemicals firm Indofil.

Indo-Reagens Plastics Additives will construct a facility at the Gujarat Industrial Development Corporation site in Dahej, which is due to be completed within the company's 2019 fiscal year.

The new venture will produce calcium-organic solid stabilisers to compete with lead-based stabilisers. It will offer a full range of PVC additives, including the full family of Reagens products for rigid PVC, C-PVC and flexible PVC, including tin stabilisers and boosters and liquid mixed metal soap systems. The JV business will provide technical support and services from Indofil's regional application

laboratory centres at Thane and Delhi.

"We will work together to bring cost-effective and sustainable solutions in the heat stabilisers market," said Ettore Nanni, CEO of Reagens and President of Indo-Reagens. "The new plant will be based on state-of-the-art technologies in order to assure maximum efficiency, quality and safety standards."

➤ [www.reagens-group.com](http://www.reagens-group.com)

## R&P Polyplastic aims for LFTs

Russian compounder R&P Polyplastic has announced plans to produce its first commercial long fibre reinforced thermoplastics (LFTs), which it will market under the Armalong name.

The company said it is currently installing its first production line, which will have a capacity of around 2,000 tonnes/yr and will commence production in Q4 of this year. A spokesperson for the company said the production line has been created by its own engineers in its Research and Development Centre in Moscow using parts sourced from

leading European manufacturers.

The spokesperson told *Compounding World* that the Armalong products will be based on polypropylene resins, but this will be extended to include polyamide and other polymers "in the near future". All will use glass fibre reinforcements.

The company will be targeting metal replacement applications in markets such as aerospace and transportation. The initial geographical focus will be on the Russian and CIS countries.

➤ [www.polyplastic-compounds.ru/en](http://www.polyplastic-compounds.ru/en)

## Global masterbatch demand growing at 5% a year

Global demand for plastics masterbatch is growing at around 5% a year, outstripping both GDP growth and expanding demand for plastics in general.

These above GDP growth rates are expected to continue for the near future, according to AMI Consulting's new report *Thermoplastics Masterbatch - The Global Market 2019*.

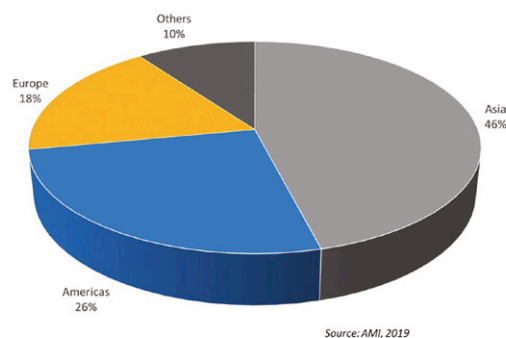
The report details the emergence of global players and the growing role of private equity in the masterbatch industry. It also looks at how the industry may be affected by the emergence of the circular economy; almost two thirds of colour masterbatch demand comes from the packaging industry.

For more information contact Sarah Phillips. Email:

[sjp@amiplastics.com](mailto:sjp@amiplastics.com)

FIGURE 1:  
THE GLOBAL MARKET FOR THERMOPLASTIC MASTERBATCH

AMI



Source: AMI, 2019

An AMI Consulting report - Thermoplastic Masterbatch - The Global Market 2019



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# Chroma Color acquires Polymer Concentrates

Chroma Color Corporation, a speciality colour and additive concentrates supplier headquartered at McHenry in Illinois in the US, has continued to expand with the acquisition of Polymer Concentrates, which is based at Clinton in Massachusetts.

Chroma Color said that the move will allow it to "continue to grow its manufacturing footprint along with its suite of colorant and additive technologies to better serve existing and prospective customers."

Established for around 50 years, Polymer Concentrates mainly supplies colour concentrates for PA and other engineering plastics in



the automotive, communication technology, wire and cable, housewares, netting, packaging and other speciality sectors. Its facility is located quite close to that of Chroma Color in Leominster, Massachusetts.

Chroma Color CEO Tom Bolger said that the two companies "have complementary product lines, but distinctly different customer

bases", making the merger particularly attractive.

Owned by investment group Arsenal Capital Partners, Chroma Color Corporation was formed in 2018 from the combination of Carolina Color Corp, Chroma Corporation, Breen Color and Hudson Color. The group generates sales of around \$160m.

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

## US machine shipments up in Q4

US shipments of plastics machinery in Q4 2018 were up by 8% on Q3 at \$377m, matching the result for Q4 2017, according to data from the Committee on Equipment Statistics at the Plastics Industry Association.

Injection machinery shipments were up by 8.8% in value terms, with single and twin screw extruder shipments up by 4.6% and 1.5% respectively.

"We projected higher shipments for the fourth quarter and that's exactly what transpired," said Perc Pineda, Chief Economist at the Plastics association. "The increase is not due to inflationary pressures of the economy, which one tends to think about when dollar value increases, but purely an increase in the quantity of shipments."

The CES also conducts a quarterly survey of market conditions and outlook. It said 75% of respondents expected conditions to hold steady or improve for Q1 2019.

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

## Motan-Colortronic grows in India

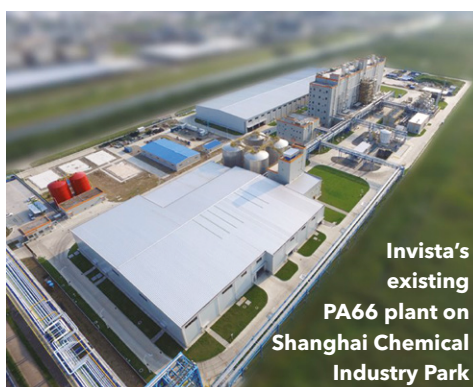
Motan Group subsidiary Motan-Colortronic Plastics Machinery has moved to new premises in Chennai, where it has tripled its production and storage space and extended its locally manufacturer product lines.

"Now, we not only cover the increasing demand for high quality peripheral units and systems, but also provide shorter delivery

times", said managing director Srikanth Padmanabhan. "Also, with the new products we can now also serve additional segments, such as extrusion and compounding."

The new facility was opened by Karin Stoll, the German consul-general in India, and Motan CEO Sandra Füllsack.

➤ [www.motan-colortronic.com](http://www.motan-colortronic.com)



Invista's existing PA66 plant on Shanghai Chemical Industry Park

## Invista moves on ADN

Invista has signed a memorandum of cooperation with the Shanghai Chemical Industry Park (SCIP) in Shanghai covering the development of a 400,000 tonnes/yr adiponitrile (ADN) plant.

The deal will see engineering work commence for a \$1bn ADN plant that could be integrated into Invista's existing HMD and PA66 polymer production at SCIP. ADN is a key ingredient in the production of PA66, which is in global short supply at the present time. Construction is expected to start in 2020 with start-up scheduled for 2022.

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

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# ECHA creates additives inventory

The European Chemicals Agency (ECHA) has published a comprehensive inventory of plastic additives currently used in the EU, including plasticisers, flame retardants, antioxidants, pigments, heat stabilisers and others.

The work was carried out over two years with trade bodies Cefic, Plastics-Europe and European Plastics Converters, together with academics and EU member state representatives. It screened some 1,000 substances to identify those being used and to validate data on their intrinsic properties, so enabling ECHA to develop a



PHOTO: SHUTTERSTOCK

model to calculate the release potential of each substance into the environment.

ECHA said regulators in EU member states "will be able to use this inventory as a starting point to decide which

substances should be assessed as a matter of priority." Companies will also be able to use it to refine data about uses and exposure potential in their REACH registration dossiers, it said.

The project began in late 2016 and ran until December 2018, with 21 industry sector organisations involved. It is part of ECHA's commitment to map all substances registered under REACH in the >100 tonnes/year band. In all, 419 substances used as plastic additives, all functional additives and pigments, were above this threshold.

> <http://echa.europa.eu>

## PCEP head appointed

Venetia Spencer has been appointed Secretary General of PCEP, the Polyolefin Circular Economy Platform. Founded by EuPC and PlasticsEurope, the Brussels-based organisation is a value chain initiative that aims to increase the reuse and recycling of polyolefin products.

Spencer joins from Burston-Marsteller, where she was head of its environment and energy consulting team.

> [www.pcep.eu](http://www.pcep.eu)

## Nouryon double peroxides capacity

Nouryon, the former AkzoNobel Speciality Chemicals business, has more than doubled capacity for emulsion-based organic peroxides at its site in Los Reyes, Mexico, to meet growing demand from the North American PVC market.

The company introduced these peroxide products in North America only last year as an alternative to solvent-based peroxides. It says that they "are inherently safer while also improving product quality". They also play a key role in Nouryon's patented continuous

initiator dosing technology, which allows PVC producers to increase reactor output by up to 40% for little additional outlay.

The Los Reyes move is the latest in a string of

Nouryon investments, including other expansions in Mexico, upgrades to capacity in China and India, and the acquisition of Polinox in Brazil.

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



PHOTO: NOURYON

Nouryon's organic peroxide facility at Los Reyes in Mexico

## CuRe start-up targets PET recycling

Three Dutch companies - polyester recrystalliser Cumapol, carpet recycler DSM-Niaga and multi-site plastics recycler Morssinkhof Plastics - have launched CuRe, which they describe as a "new investment in low energy polyester recycling" and "a major step towards a fully circular polyester chain".

The CuRe aim is to recycle varied

polyester waste streams for demanding applications such as carpets, textiles and food packaging. According to Cumapol, the technology "allows us to treat any type of used polyester, remove the colour and turn it back into clear pellets with the same properties as virgin grade polyester".

The first step will be to construct a

20 kg/h pilot plant at Emmen in the Netherlands to prove the technical and financial sustainability of the technology. Future plans include the conversion of existing and idle solid state polymerisation lines at Cumapol's Emmen site to scale up to a capacity of 25,000 tonnes/year.

> [www.cumapol.nl](http://www.cumapol.nl)

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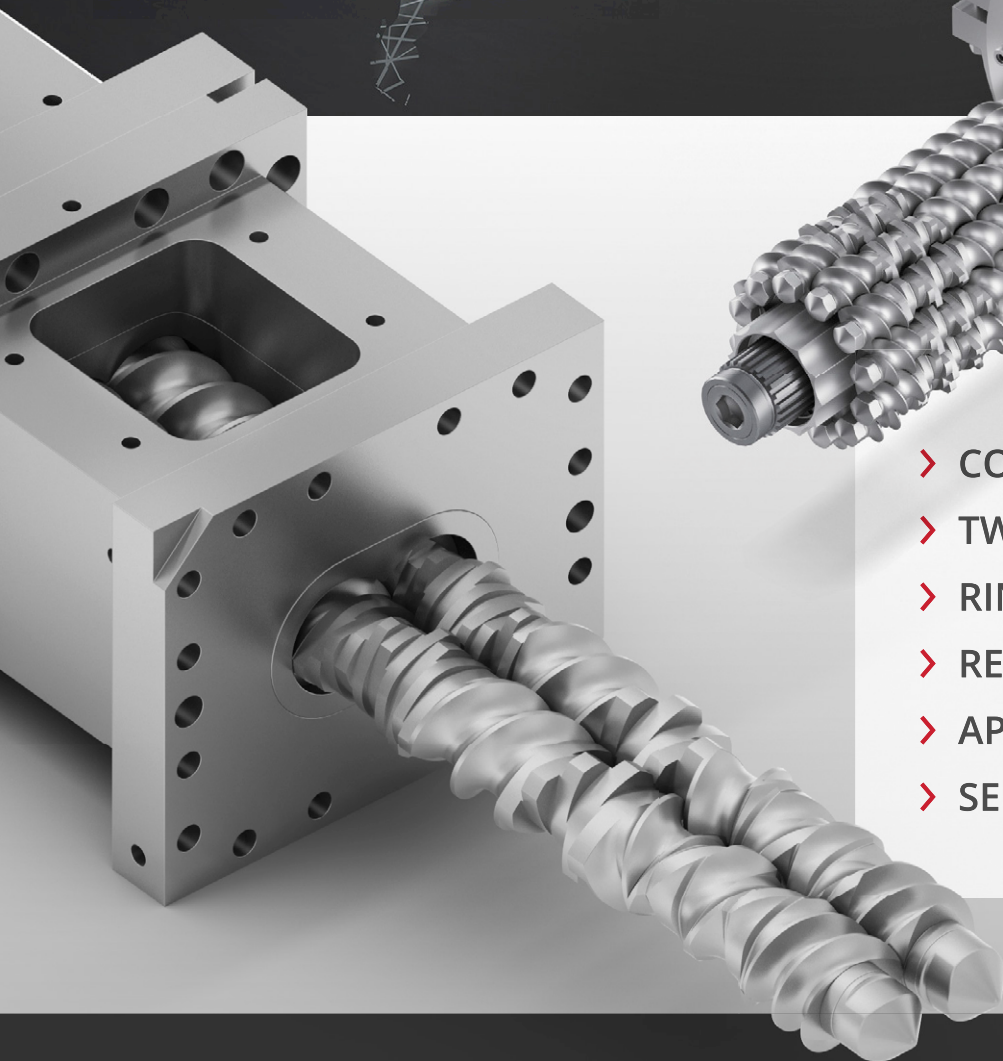
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# Join the party at the Rock and Roll Hall of Fame in Cleveland

Cleveland's iconic Rock and Roll Hall of Fame will be the venue for a major networking party for the plastics industry on the evening of May 8, 2019. The event will be open to visitors and exhibitors from the plastics extrusion, recycling and compounding tradeshow, which are being held at the nearby Huntington Convention Center on May 8-9.

Admission to the Plastics Recycling World Expo, Plastics Extrusion World Expo and the Compounding World Expo plus their associated conferences is free-of-charge if you [register in advance](#). Advance tickets for the networking party cost just \$20 (less than a standard ticket), and they include exclusive access to all of the Rock and Roll Hall of Fame exhibits, plus a drink and some nibbles - [details here](#). The party will run from 7:00PM to 11:00PM.

"This fantastic venue will provide a great place for attendees to relax and network after a busy first day at the exhibitions, which will feature more than 230 exhibitors and over 120 speakers across five free-to-attend conference theatres," said Rita Andrews, Head of Exhibitions at AMI, the organiser of the events.

Located on the shore of Lake Erie in downtown Cleveland, the Rock and Roll



Hall of Fame is a short walk from the Huntington Convention Center and neighbouring hotels. Housed in an eye-catching structure designed by I M Pei, it boasts an extensive collection of popular music artefacts spread over six floors. Multi-media exhibits map out the history of rock music and the people who created it.

The breadth and depth of the display is hugely impressive, covering everything from the birth of rock and roll through to current pop stars and all in between. Fans of rock, pop, blues, country, folk, gospel, soul, funk, R&B, heavy metal, punk, new wave or hip hop will all find plenty to enjoy among the thousands of objects on display.

For example, the attractions include Jimi Hendrix's Stratocaster guitar, David Bowie's iconic outfits, Keith Moon's platform shoes, John Lennon's Sgt Pepper suit, Run DMC's Adidas sneakers, and the awning from legendary New York venue CBGB.

The Hall of Fame also features exhibits on cities that have had a major impact on the development of rock and roll, including Memphis, Detroit, London, Liverpool, San Francisco, Los Angeles, New York, and Seattle. There are also displays focusing on the influential local music scenes in Cleveland, Akron and beyond.

For those who have been lucky enough to visit the attraction before, there is

always something new to see including recent acquisitions and constantly evolving temporary exhibits. This year there are displays honouring the 2019 inductees to the Hall of Fame, which are The Cure, Def Leppard, Janet Jackson, Stevie Nicks, Radiohead, Roxy Music and The Zombies. Another new addition will be an interactive display featuring rock-themed pinball machines to play on.

The party is being sponsored by Technical Process & Engineering (TPEI) and ENTEK, and is supported by AMI's magazines - *Plastics Recycling World*, *Compounding World*, *Film and Sheet Extrusion* and *Pipe and Profile Extrusion*.

For more information on the Rock and Roll Hall of Fame party and to register for the three industry tradeshow and their five focused conference theatres for free, please visit: [www.plasticsrecyclingworldexpo.com/na/](http://www.plasticsrecyclingworldexpo.com/na/)

# Modelling mechanical properties of heterophase PP copolymers

Unipetrol has updated its computer simulation tools for prediction and optimisation of stiffness and toughness of heterophase PP copolymers

Production of impact polypropylene copolymers is a relatively complex manufacturing process that is highly demanding from the process control point of view. Just a small variation in polymerisation conditions – for example, a change in polypropylene matrix molecular weight and external donor concentration, or in the ethylene content in the copolymer or its ratio in the propylene/ethylene rubber phase – can cause unexpected changes in structure, composition and properties of the resulting copolymer. The case is particularly complicated when several polymerisation condition changes occur simultaneously.

Czech petrochemical group Unipetrol has recently enhanced its copolymerisation modelling tools – developed at the Unipetrol RPA within the Polymer Institute Brno – to enable simulation of a variety of polymerisation parameters and the prediction of the resulting mechanical properties of heterophase copolymers.

Toughness of heterophase copolymers is mainly influenced by the rubber phase, particularly the ethylene-propylene rubber (RC) domain content in the heterophase copolymer, and by



PP polymerisation reactors in the Unipetrol RPA laboratory at Brno

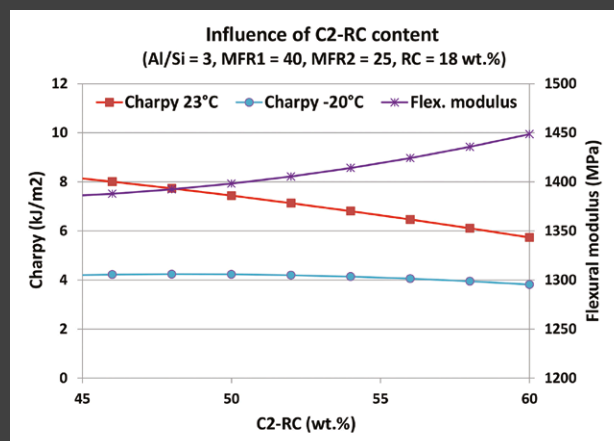
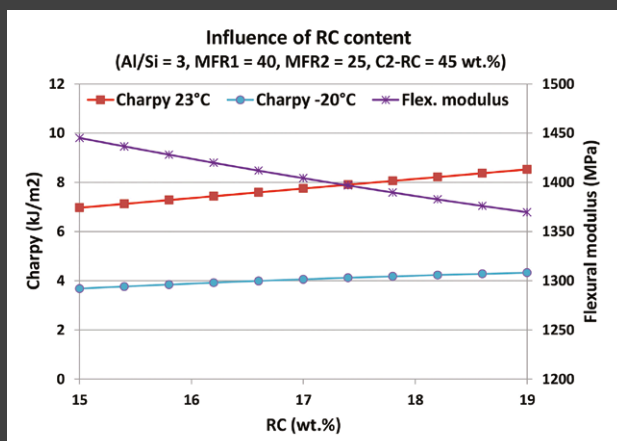
the ethylene content in the rubber phase (C2-RC). Generally, the higher the rubber content, the greater the toughness. However, the increase in this key parameter is also manifested by additional effects, such as a decrease in heterophase copolymer stiffness. The isotacticity of the homopolymer matrix (Al/Si molar ratio), its melt flow rate (MFR1) and the melt flow rate of the resulting heterophase copolymer (MFR2) have an additional, but lesser effect, on mechanical properties of the heterophase copolymers.

The Unipetrol copolymerisation model was based on the mechanical property data pertaining to 28 copolymer samples, synthesised at defined ranges of the above mentioned parameters. The multi-dimensional regression analysis of the impact of these five parameters (Al/Si,

MFR1, MFR2, RC, C2-RC) on the heterophase copolymer stiffness and toughness led to the model, represented by sample dependencies in Figure 1. Based on the input of these five variables, the resulting copolymerisation model enables the calculation and optimization of the stiffness and the toughness of the resulting heterophase copolymer.

Unipetrol says that the newly enhanced copolymerisation model can be used in two principal ways. Firstly, as a tool for on-line prediction of mechanical properties during the particular copolymer grade production. And secondly, as an aid for optimisation of polymerisation conditions leading to synthesis of improved copolymer grades with a convenient combination of stiffness/toughness properties.

Figure 1: Graphs showing dependence of heterophase copolymer mechanical properties (flexural modulus and Charpy impact strength) on copolymer composition (RC and C2-RC)



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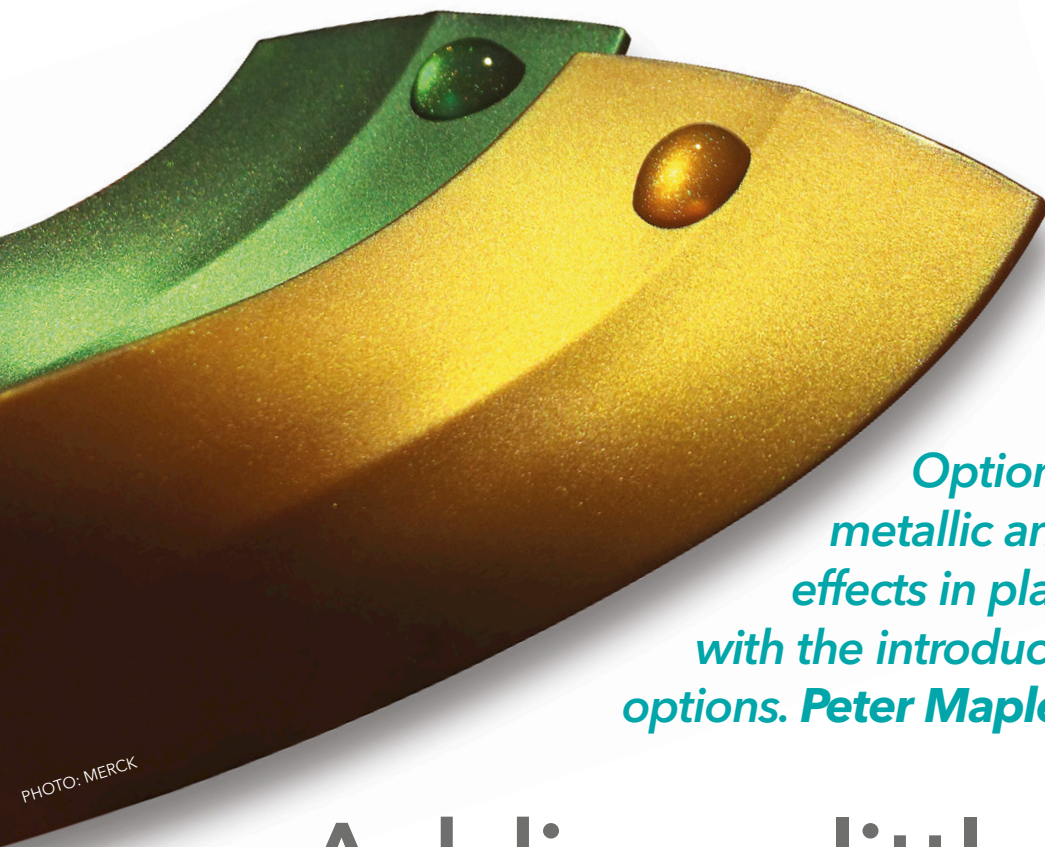
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*Options to create sparkling metallic and luxury pearlescent effects in plastics are broadening with the introduction of new pigment options. Peter Mapleston finds out more*

# Adding a little sparkle

Nature – and the sea in particular – features heavily among the latest special effects and colours from leading pigment and masterbatch producers with mermaids making an appearance in the marketing materials from more than one supplier. While the colours inspired by those mythical sea creatures tend to the blues and greens, the ocean theme is also present in Pantone's Color of the Year 2019. Living Coral (Pantone 16-1546) is described as an orange-based shade with a golden undertone. Innovation is not all about colour though. Additive suppliers are talking up the overall performance of their new ranges of colours and effects.

**BASF**, which is a major pigment producer, has an ongoing collaboration with the Pantone Color Institute. Earlier this year, it said it had created a collection of plastic designs inspired by Pantone 16-1546. The company says its new pigments "accentuate colour, finish and design all while meeting versatile industry requirements."

Meli Laurance, Commercial Industry Manager for Plastics at BASF, says the company's new marketing campaign "demonstrates how our pigments enable performance in plastic designs. Drawing on the life-affirming and energising shade of Living Coral, we were inspired to create a shade collection that first dazzles the consumer, and further, reliably and safely performs in the targeted applications."

BASF has created a collection of eight pre-defined shade formulations, which it says are based

on three key concepts: Perform until the last moment, with colours that comply with complex technological requirements and can withstand extreme strain; Enjoy a safe consumer experience, with high-purity pigments for sensitive markets like food contact applications and toys; and Discover sparkling moments, with combinations of chromatic organic pigments and effects that are natural and sustainably mined.

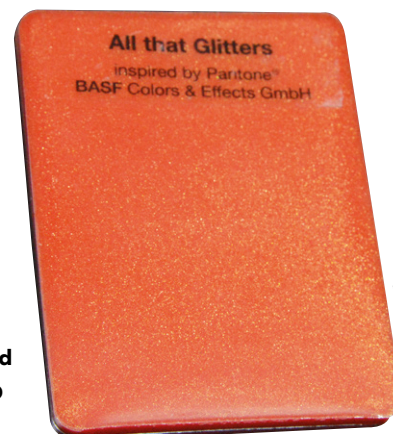
## Brilliant sparkle

Laurance says the company's Lumina Royal special effect product family features an optimised particle size that delivers very high chromaticity in a wide variety of applications. "It adds brilliance to vibrant stylings from green gold to greenish blue shades through coppers and oranges," she says. The pigments are said to provide increased chromaticity at the reflection angle and higher colour purity and clarity than traditional interference colours. The claimed result is cleaner shades, more saturated colours, and stronger flop effects.

The highest lightness and strongest sparkle Lumina Royal Dragon Gold

**Right: This Living Coral plaque is moulded using Lumina Royal Dragon Gold 9S282D from BASF Colors and Effects**

**Main image: Originally applied in coating applications, metallic pigments such as Xirallic from Merck can now be used to considerable effect in plastics**



**Right: BASF's Super Sparkle 9110S is a natural mica-based pigment that creates an impression of depth and lustre**



9S282D is used in the Living Coral effect shade "All that Glitters." This shade takes its yellowish tone completely from the Lumina Royal Dragon Gold 9S282D and is presented in a semi-transparent TPU. The greenish gold appearance from the effect pigment, which Laurance claims is unique, offers an extension of colour space. "Due to its excellent chroma, it enables new brilliant styling options combined with greater formulation flexibility," she says.

In early summer 2019, BASF will launch two new Lumina Royal products that are highly chromatic and expand the brilliant red colour space.

The Living Coral effect shade "Natural Wonder" contains Super Sparkle 9110S, a natural mica-based pigment from BASF. Mearlin mica pigments are transparent and light-reflecting thanks to their smooth surfaces and high index of refraction. Light reflected from the platelets is said to create a sense of depth and a lustre that ranges from satin-sheen to sparkly or glitter-like effects. Some Mearlin effect pigments exhibit a multiple colour play and flop in which the colour changes with viewing angle. All of the natural mica used in BASF Colors & Effects pigments is sourced at the company's mine at

Hartwell in Georgia in the US.

**Sun Chemical** Performance Pigments (part of DIC), is another leading supplier of effect pigments, with a product line that includes pearlescent and metallic types. Anthony Rohrer, Product Specialist - Effect Pigments, says the company has seen tremendous recent growth in effects pigments for plastics. "Sun Chemical looks to several other markets its serves to predict trends," he says. "Glitters and holographic looks are all the rage in cosmetics, but subtle white pearl effects and highly chromatic reds are popular in automotive stylings. It is understood that what works well in one application cannot always translate directly to another and that is especially the case in plastics."

Recent introductions from the company include SunMica Deep Black Pearlescent 284-7241, SunMica Lux Synthetic Mica Effects, and Benda-Lutz Compal 4474K. The first is said to offer exceptional lustre, sparkle and jetness compared to other commercially available black pigments. SunMica Lux Synthetic Mica Effects are pearlescents, created with ultra-smooth, optically pure synthetic mica (fluorophlogopite). Rohrer says they create noticeably brighter and cleaner effects in plastic parts. Synthetic mica does not display the off-white undertone of natural mica and Sun Chemical has expanded this line to include white, interference, earth tone, and colour travel effects.

Benda-Lutz Compal 4474K is a 100%-solid, highly concentrated aluminum preparation, which Rohrer says enables customers to use metallic pigments in an easy to incorporate form factor - pellets. "With new ultra-thin silver dollar technology, COMPAL K can push the limits of brightness and brilliance in moulded plastics," he says. ➤

## Multiple dimensions for packaging

One well-established way to achieve striking surface effects and decorative elements in applications such as packaging is to mix polymers with pearlescent pigments. The result adds gloss, brilliance, and considerable visual depth. Merck recently introduced IM3D technology, which it says exploits this property of effect pigments to make flat surfaces look three-dimensional (it collaborated with PolyOne in this area).

The effect of depth is achieved by over-moulding an insert film or preform containing the pigments with

a transparent or semi-transparent resin. "This multisensory experience creates a double wow effect while standing in front of the shelf: first when seeing the spatial patterns, and second when touching the surface



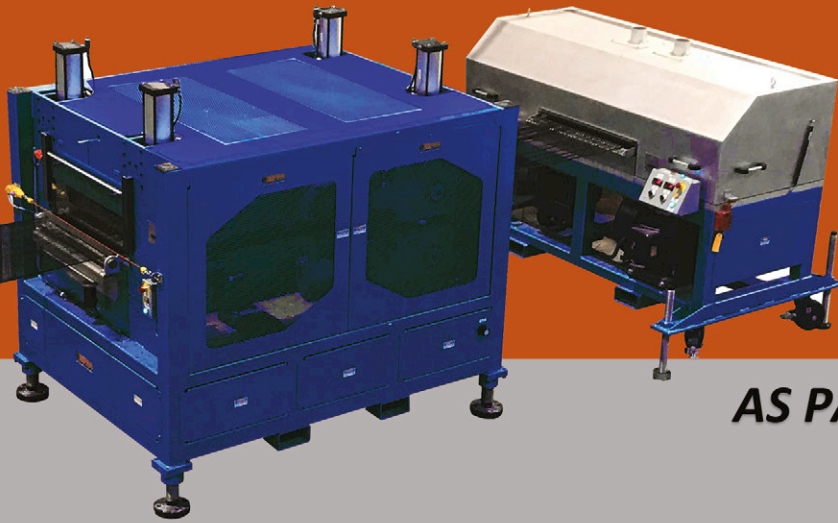
and realising that it is flat after all," says Merck.

The company says IM3D technology enables users to create innovative, eye-catching 3D designs for injection-moulded parts, using its pearlescent pigments regardless of any particle's size and without creating any unintended flow lines.

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

**Left: The 3D effect on this flat surface is achieved using Merck metallic and pearlescent pigments in combination with overmoulding**

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**Coatings to compounds**

Special effect pigments are more widely used in coatings - whether that be for cars or fingernails - than in moulding compounds, but **Merck** says that the most innovative colour grades in its Xirallic product range for automotive coatings are now also available for the plastics industry. Xirallic pigments are based on aluminium oxide platelets covered with highly refractive metal oxides and are characterised by a strong glitter effect with a distinct shimmering behaviour.

Silver-white effect pigments as well as interference pigments in gold, red, blue, green, violet and turquoise can be generated using titanium oxide in varying degrees of thickness. Layers of iron (III) oxide produce copper-coloured and red effect pigments.

Merck says the platelets are produced in a process that yields highly consistent, highly reflective surfaces and tight particle size distribution. The fine particle size makes the pigments easier to process than rival pigments intended to produce a similar glitter effect but that are based on larger particles.

Merck also claims that, because the substrate of Xirallic has no mass tone colour, pure effects can be produced even in white stylings. "Its high level of transparency also makes it ideally suited to dark stylings without cloudiness," the company adds. "In consumer electronics, domestic devices, and especially packaging, the effect pigments' intense sparkle and colours can generate a premium look," Merck says. The pigments are

suitable for food contact applications.

The company also highlights its WAY (Weathering resistance, Anti-Yellowing) technology, which it says is a novel solution for prevention of damage and discoloration of pigmented compounds exposed to ultraviolet (UV) light. It says a special encapsulation makes the pigments less photoactive, and at the same time provides resistance to aggressive chemicals and prevents the polymer from yellowing. Merck is aiming WAY-pigments at various outdoor applications, including automotive, architectural products, and furniture.

Meanwhile, **Eckart** has developed two highly chromatic effect pigments in silver and gold pellet form - Mastersafe Symic C 393 and Mastersafe Symic A/C/E 001L - as well as a new Edelstein orange pearlescent pigment. The Mastersafe Symic pigments are additions to the company's existing Symic product range and are compacted into dust-free pellets to facilitate dosing and handling. Eckart foresees applications in automotive, household and electrical appliances, and also cosmetics and food packaging, since the pellets are suitable for food contact use.

The Edelstein Topaz Orange pigment is the second product in the Edelstein portfolio. The highly chromatic synthetic pearlescent pigment permits brilliant orange-metallic shades, expanding the colour space opened by the company's original Eckart Ruby Red. Both are based on Eckart's patented coating technology for layered silicates and are said to show "superb" chemical and shear stability. Eckart is targeting cosmetic, sports and life-style products in particular with the Edelstein Topaz Orange grade. ➤



**Above: Mastersafe Symic pigments are compacted into pellets to improve ease of handling**

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# “ENTEK Extruders Have Helped Us Expand Our Product Line, and Grow Our Business”



Jim Drew, Plant Manager, OptiColor, Inc.



Jim Drew, Plant Manager (left) and ENTEK's Linda Campbell at OptiColor, Inc.'s, Huntington Beach, CA Facility

“OptiColor, Inc. is a specialty color compounder producing custom materials for clients within the plastics industry that require superior, consistent quality with every order. We produce small to medium-sized lots of colored and tinted materials for some of the world’s leading lighting and eyewear companies.

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PHOTO: AMPACET

**Above: The new Stone Island range of masterbatches from Ampacet**

**Colourful descriptions**

When it comes to colour, the language used to promote products tend to be just as colourful as the products themselves. **Ampacet**, which recently introduced its Stone Island special effects masterbatches, does not buck that trend. The new collection “embraces the world’s natural wonders with earthy and enigmatic tones evocative of lush forests, deep canyons, vast deserts and mystical caves,” it says.

**Right: Shades of Nature masterbatches from PolyOne are said to mimic natural materials such as stone, marble, and granite**

“New technologies push consumers to a narrow, chaotic lifestyle with less time to interact with each other and the diverse natural world,” says Philippe Hugel, Ampacet Business Strategic Manager Moulding. “Connecting with the tangible beauty of the outdoors and disconnecting from the intangible digital world is essential for happiness, well-being and a quality life. The grounded and mysterious colours and solid, darker striations of this collection play into our fascination with the exotic and wild aspects of nature.”

Aimed principally at products in personal care, appliances, furniture and household items, Stone Island features patterns with subtle veining that yield three-dimensional effects. The new range

complements the Fusion FX masterbatch collection Ampacet launched a couple of years ago. Offered in four palettes - Carnival, Cork, Camouflage and GeoClassics - these also produce random colour effects.

At last year’s Fakuma plastics processing exhibition in Friedrichshafen, Germany, additives, masterbatch and compound producer **Grafe Advanced Polymers**



PHOTO: POLYONE

launched its “Mermaid Effect” range, which its Grafe-Design-Center says is an unusual multi-coloured selection of high-quality colour-changing (interference) effects - where the colour of a surface changes according to the angle from which it is viewed or from where light is shone onto it. Said to echo the colours of a mermaid’s fin, Mermaid Effect materials come in eight different flop effects, all characterised by high brilliance and strong colour change.

**Natural shades**

Also at Fakuma, **PolyOne** launched Shades of Nature, its latest collection of on-trend colours. As part of the company’s OnColor Polymer Colorants masterbatch portfolio, these masterbatch colorants - ten in all - are said to enable plastics to mimic naturally occurring materials such as stone, marble, and granite. PolyOne says the collection was developed to address the trend toward creating products that appear more natural and less manufactured.

“Designers today increasingly value individuality over uniformity in markets such as cosmetics, electronics, appliances, and building materials,” says PolyOne. “This trend began with the ‘green’ building movement, which revels in imperfect and textured natural materials such as bamboo, stone, marble, and minerals.”

PolyOne says the new colours will offer brand



PHOTO: GRAFE

**Mermaid Effects is a colour changing interference range of masterbatches from Grafe**

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## TALMIO - Talc series

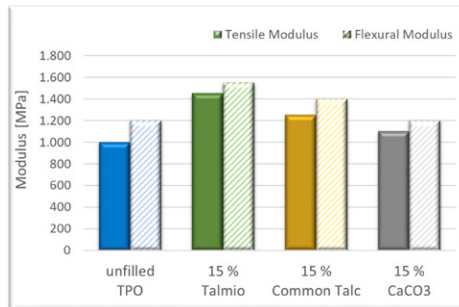
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Kärntner Montanindustrie has specialized on finest Talc types which are highly delaminated and lead with their high aspect ratio to excellent performance.

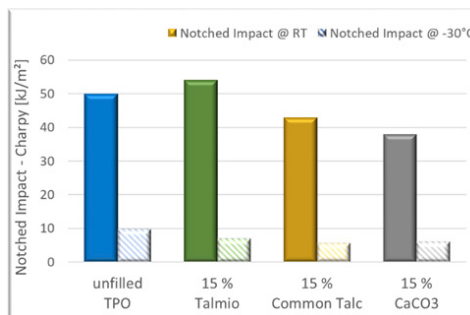
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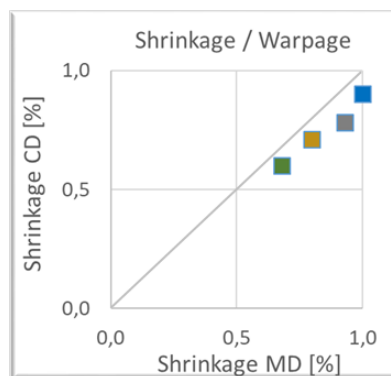
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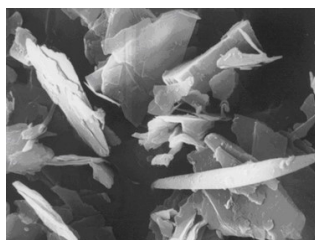
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**Right: Gabriel-Chemie says its latest line of colours range from pastels to metallics and combine nostalgia and modernity**

owners a wide range of possibilities in creating individual, artisanal looks in plastic. Each shade is created from a mix of pigments and particles that span almond shells, reflective flake, synthetic fibres and pearlescents. "In combination with surface texture and part geometry, these masterbatches give plastic parts the appearance of naturally-occurring materials so that, for example, designers could create a toaster that appears to be carved out of granite," the supplier says.

The colours can be customised in various virgin or recycled polymers for multiple applications. In addition, the masterbatch can contain other performance and/or process-enhancing additives optimised for specific needs.

**Gabriel-Chemie** unveiled its latest Colour Vision collection at the Fakuma show. This

presents innovative colours, effects and surfaces in selected polymers in the form of plastic lens plates. The colour masterbatch specialist says the collection, which is intended to provide inspiration for plastics applications, is appreciated by branded product manufacturers and designers of consumer products, as well as plastic processors, working on new product designs.

The company has cooperated in the past with effect pigment specialist **Schlenk Metallic**

**Pigments** on the development of its Flowing Metallics series, which provide a metallic look in mouldings free of visible glitter particles. More recently the two companies teamed up with German 3D printing filament maker Herz to create PETG filaments that enable production of 3D-printed parts with the same metallic look. The original range consisted of five colours, Ocean Blue Metallic Gloss, Calm Red Metallic Gloss, Gunmetal Black Metallic Gloss, Brown Metallic Gloss and Fir Tree Metallic Gloss. Gabriel-Chemie says more colours are currently under development.

PHOTO: GABRIEL-CHEMIE



**Above: A 3D-printed part made with PETG filament containing effect pigment from Schlenk**

**Right: Plaques coloured using liquid metal-effect concentrates from Riverdale Global**

PHOTO: RIVERDALE GLOBAL

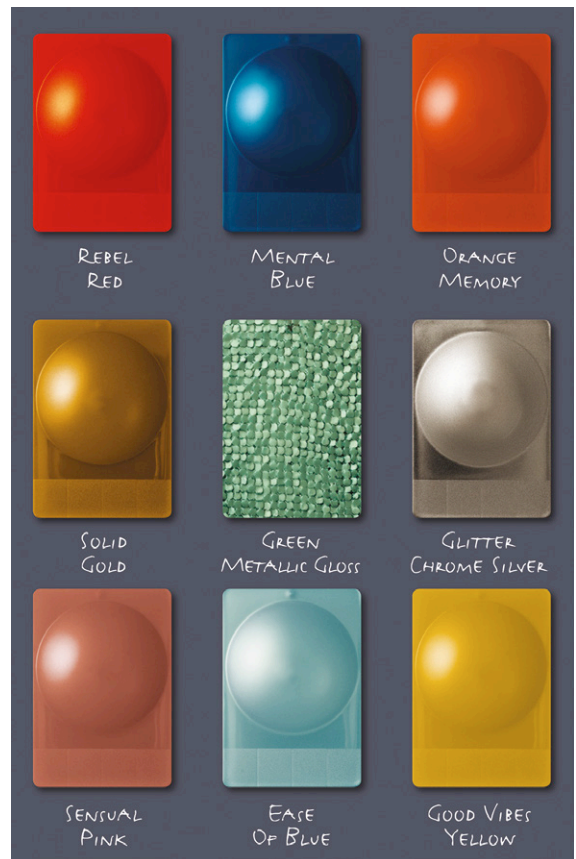
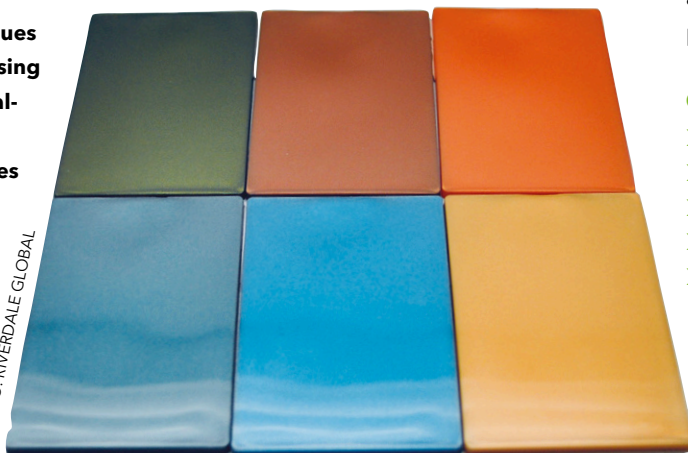


PHOTO: GABRIEL-CHEMIE

**Liquid solutions**

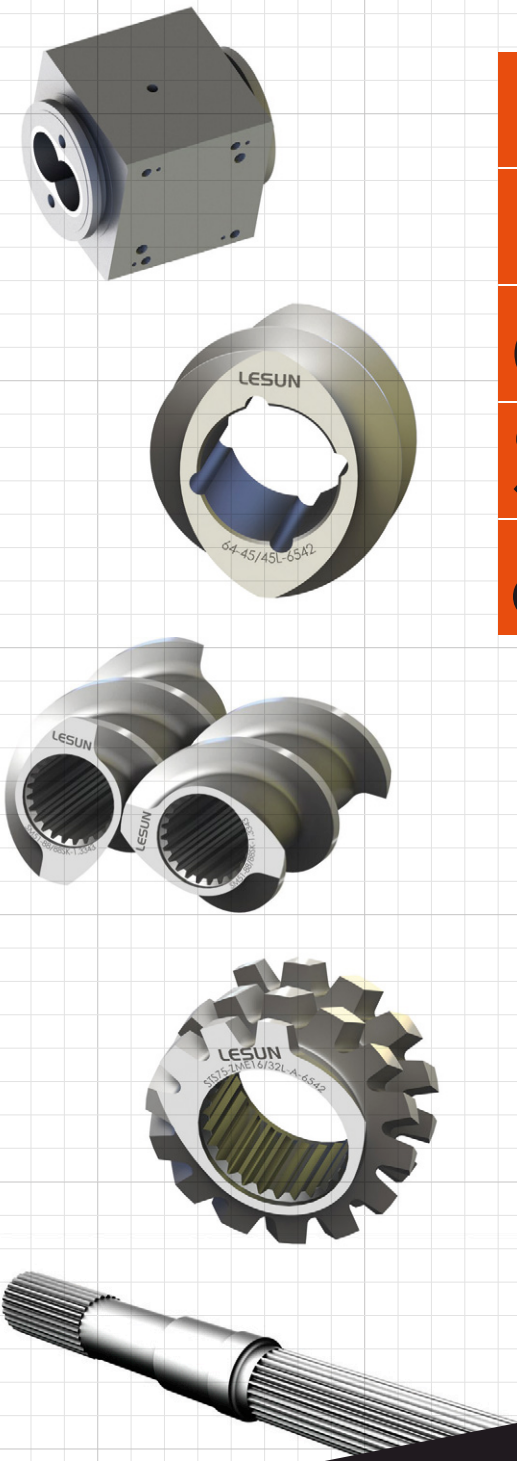
**Riverdale Global** is slightly unusual in that its latest special-effect colours are supplied in liquid form. It says that, compared to pellet masterbatch, let-down rates are lower because liquid colours have a higher pigment loading per unit weight of colourant. The liquid carrier also enhances dispersion of the pigment, according to the company.

Included in the new offering are effects such as Deep Pearl, Transparent Pearl (used at 0.5% loadings in clear resins, these colours exhibit a glitter effect), Blast (very bright pearlescent effects with little evidence of flow lines in moulded parts), Splash (a combination of bright pigments and pearlescent particles), Metal (for a surface sheen), and Metal Expression (which incorporates larger particles for a glittery metallic effect).

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

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# The natural alternative

*A wide variety of end-use applications are now making use of natural fibres from multiple sources to provide reinforcement and other performance attributes. Mark Holmes finds out more*

Increasingly today, compounders are using natural fibres in their formulations to meet environmental goals and demand from end-users for more sustainable solutions, as well as helping to meet regulatory requirements and their recycling targets within the circular economy. Expertise for handling and incorporating natural fibres is also improving at pace. As a consequence, the market for biocomposites – plastics containing natural fibres and/or nanofibres as reinforcements – continues to grow.

Norway-based research organisation **RISE PFI** reports observing various expanding areas of application, including automotive interior parts, construction and furniture. These compounds are mostly manufactured for injection moulding, but there are also interesting developments within 3D printing by fused deposition modelling, the organisation says.

"Fibre-reinforced biocomposites are stronger than the corresponding neat plastic," says Gary Chinga Carrasco, Lead Scientist - Biocomposites. "They may be cheaper too depending on the fibre

used, and there is also an environmental factor that is driving their development. Reducing the plastic in products by including natural fibres could be positive for the environment. However, this depends much on the type of application. For long-term applications, such as automotive parts, construction and furniture, this is absolutely a good option. However, the recycling of biocomposites is still a topic that needs closer attention."

There are also a number of technical issues to be addressed in terms of formulation. "The compatibility of fibres with some polymer matrices is still challenging. This is especially the case with some bioplastics, such as compostable PLA. Additionally, the interfacial compatibility between fibres and matrix may also influence the water absorption of the material or product," he says.

"Natural fibres are hygroscopic components – they absorb moisture. For structural biocomposite applications, this property is a disadvantage because the material may have limited dimensional stability. Water absorption also depends on the

**Main image:**  
Moulded in a natural fibre reinforced PP, the Alfa Romeo Giulia instrument panel weighs 3.5kg, saving more than 1kg over a glass reinforced alternative

type of matrix used, for example high density PE absorbs less water than PLA and PP. Surface modification of natural fibres, tailored for specific polymer matrices, for example PLA, is still an area of research and development. The surface modification can include chemical and biotechnological approaches, which differ with respect to costs and environmental performance. This is something that we are developing further," says Chinga Carrasco.

Other technical areas of interest include compounding in an appropriate way to preserve fibre length and improving the spatial distribution of fibres in the polymer matrix. "As well as reducing the plastic fraction, fibres also are important to improve the mechanical properties of the final product," Chinga Carrasco says. "Natural fibres are strong and for preserving the strength of the fibres in the polymer matrices it is necessary that the fibres maintain their length and aspect ratio. In compounding with some extruders, the fibre length is affected significantly and extreme shortening is experienced - from over 2 mm to less than 400 micrometres for wood fibres. The mechanical strength of the biocomposites is still high when the fibres are shortened by the extrusion process, however, this could be even higher if the fibre length is preserved. The industry has realised this limitation and new extruder concepts are desirable where the focus should be on a good dispersion of fibres in a polymer matrix without causing a shortening or degradation of the fibres. This is important to biocomposite producers."

**Fibre handling**

The handling of natural fibres in the compounding process largely depends on the type of compounder. "From a wood fibre point of view it is important that the fibres are pelletised cor-

rectly, and that the fibres have a good pellet density to be fed into an extruder, although, this depends on the type of compounding system. For some compounders, it may be an advantage to have fluffy fibre pellets; for others it is necessary to compact the fibre pellets to a higher density. The same applies to the moisture content of fibres, which could be managed differently by different compounders, with or without degassing units. Another factor is of course the equipment for pelletising the compounds," he says.

"We have been working closely with Norske Skog, a wood fibre and paper producer in Norway, to explore the potential of wood pulp fibres, specifically thermo-mechanical pulp (TMP), to be used in compounding processes. In particular this is for biocomposite products for Norwegian plastic product producers - both injection moulded and extruded products. We have gained much experience with the type of fibre, fibre pellets and plastics that could be used for specific products."

One of the key areas of focus has been the interfacial adhesion between the fibres and the plastic, and modification of fibres to reduce water uptake. "In collaboration with other European groups, we have developed a benign and environmentally sound approach to modify wood pulp fibres and increase interfacial adhesion with a given polymer matrix, for example PE and PLA, as well as reducing the water uptake of the biocomposites. This is a process with the potential to be implemented industrially. The product could be the modified fibres for compounding or even the compounds instead, where I expect there is economical potential," Chinga Carrasco says.

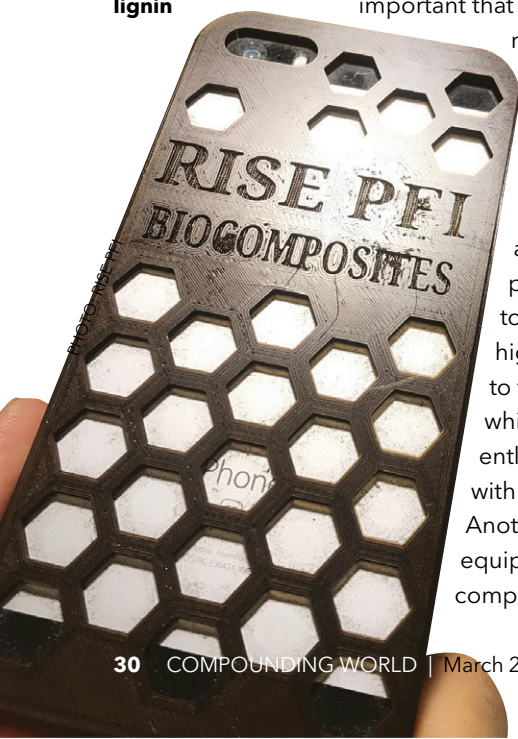
"Together with European and South American research groups and industrial partners, we started the ValBio-3D project in 2017," he says. "This project is about using agro-forestry residues to produce fibres, nanocellulose and bioplastics for 3D printing. A bioplastic we have focused on is second generation bio-based polyethylene from sugarcane bagasse. Presently, BioPE is produced commercially from sugarcane, but we are taking a closer look at the side-products of this industry such as bagasse."

**Agricultural residues**

RISE PFI says that bagasse is a major agro-industrial residue and finding new applications for it is of major importance. In 2016, world production of sugarcane was estimated at 1,9bn tonnes. With around 270-280 kg of bagasse generated for every tonne of harvested sugarcane the volumes are huge. The research organisation says bagasse can provide a source of fibres for reinforcement of bioplastics, for production of nanocellulose and also, potentially, for production of second generation BioPE. All depend on developing optimised, sustainable and cost effective processes for fractionation.

Another potentially interesting and under-utilised agro-forestry side products is lignin. "In addition to cellulose and hemicellulose, lignin is one of the three major components in lignocellulosic biomass. Wood fibres are usually used as

**Below: A smartphone cover 3D printed at RISE PFI in Norway using a PLA biocomposite reinforced with lignin**



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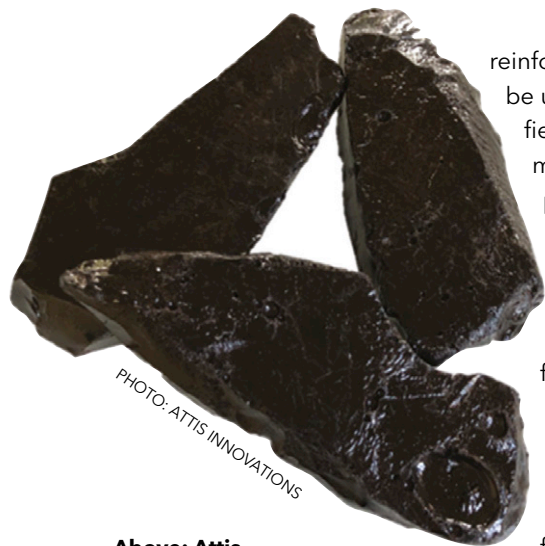


PHOTO: ATTIS INNOVATIONS

**Above: Attis Innovations uses a modified organosolv process to convert woody biomass into constituent products such as lignin**

**Right: Attis Innovations claims to have fully compatibilised lignin in polymer compounds based on PE and PP**

reinforcement, but lignin can also be used as a filler and, if modified correctly, as a polymer matrix for biocomposite production. This still requires some further research but we are moving in this direction," Chinga Carrasco says. "Presently, most effort for utilising lignin is in combination with bioplastics such as PLA, but we are also exploring routes to use lignin as a thermoplastic material for injection moulding and 3D

printing, for example. We are looking to reconstruct and mimic wood by utilising lignin as a matrix reinforced with wood fibres - all from underutilised side products."

RISE PFI is also looking for new routes to use biomass for the production of sustainable biocomposite materials, including bioplastics, fibre and nanocellulose. "Nanocellulose is also an area where we at RISE PFI have major competence and a library of lignocellulosic fibres and nanofibres for specific biocomposite applications is being developed," he says. "In this case - based on a bio- and circular economic strategy - we foresee the utilisation of agro-industrial side products as most interesting. There is much biomass that could be upgraded and valorised in a better way than burning it as a source of energy."

**Fibre modification**

**Attis Innovations** has developed a its own approach to processing natural fibres for use in plastic compounds. "Attis can use its proprietary modified organosolv process to convert woody biomass into constituent products, including a lignin unlike all others," says Bob Montgomery, Vice-President Product Development. "This lignin stands in sharp contrast to the historical understanding of lignin, as it abandons the stiff, fibrous form in favour of a melt-flowing thermoplastic product. By flowing at temperature, part design limitations are largely stripped away, giving the designer far more flexibility. This melt-flowing product can be inexpensively compatibilised with HDPE, PP and many other polymers efficiently."

To date, Attis says it has successfully compatibilised the lignin to meet the tensile strength, tensile modulus and impact characteristics of unfilled composites effectively with load levels of 15% and 25% in HDPE and PP, respectively. While the company says it is actively pursuing multiple channels to increase the value of its lignin product, polymeric addition remains a key arena for future product growth. Montgomery says the biggest value proposition for natural fibres is their ability to stiffen a composite with a lower part weight addition than glass filled composites, which has a real value in transportation applications.

The company says current issues it is working on include increasingly complex geometries, and improvements to mould and part design that mean less forgiving processing conditions. "For top-down captive moulders, downstream feeding can reduce shear and residence time," says Montgomery. "For other processers, controlling nozzle and gate diameters, screw compression ratio and screw design can all reduce shear and provide for a more robust product. We have also developed a very different product - a thermoplastic lignin product that can melt and flow along with a polymer, rendering it vastly more flexible in part design."



PHOTO: ATTIS INNOVATIONS

Dr Elspeth MacRae, Chief Innovation and Science Officer at Crown research institute **Scion** in New Zealand, also sees a growing market and consumer demand for a switch from fossil or mineral-based resources to renewable bio-based materials. Other factors in the shift include legislation around end-of-life recycling and the movement towards a circular bioeconomy where materials are used and reused efficiently.

Wood-fibre based Woodforce, developed by Scion and licenced to **Sonae Arauco**, is a natural and sustainable material that produces lightweight polymer composites that can be recycled several times without losing functionality. "The use of Woodforce is slowly gaining momentum with a number of compounders using it to develop specialist, high performance plastics. There is great potential for nanocellulose in composites. Whether as fibres or a component of gels or foams, a broad range of applications is foreseen, with nanocellulose reinforcing, lightweighting and replacing petroleum products or controlling





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**Right:**  
**DuraSense**  
**biocomposite**  
**granules from**  
**Stora Enso**

moisture, for example," MacRae says. "Nanocellulose is currently sold in water - 97% water/3% NC. Dewatering and incorporating it into a plastic matrix, and creating a good interaction between the two at an industrially relevant scale is the main challenge. Lignocellulosic fibres are very hydrophilic, while most polymer matrices are hydrophobic. Ongoing work is looking at ways to modify the fibres in a green, sustainable way so that they are compatible with the matrix and can achieve their full reinforcing potential," she says.

**Fibre interaction**

Scion is also working on the interaction of fibres and biopolymers, such as PLA and PHA. Being able to produce dry and usable nanocellulose would be considered a huge advantage. However, current processes to dry it without the particle fibres/ particle aggregating (hornification) are complex and cumbersome.

"Cellulose can be found in odd places, such as cow faeces. The cows that are part of New Zealand's large dairy industry do a good job of processing grass into cellulose and ensure that a constant supply is available. Effluent collected from places such as dairy sheds can be a serious waste management problem," MacRae says. "Work at Scion has found that the right combinations of dairy effluent, additives and bioplastics can produce composites with a range of properties. Dairy effluent/PLA biocomposites, for example, weather and degrade faster than PLA alone, opening up possibilities for biodegradable plastics in primary industry applications. Work is also underway to explore the potential of algae as a source of nanocellulose. Other research is exploring the potential of protein-based nano fibrils."

**Below: Wood**  
**fibre dice and**  
**wood fibre**  
**reinforced**  
**plastic**  
**composite pots**

There is increased market demand for reducing the usage of fossil-based materials in plastics by substituting them without compromising the



PHOTO: STORA ENSO

product properties, according to Patricia Oddshammar, Head of Biocomposites at **Stora Enso**, the Swedish-Finnish supplier of wood fibre products. "Brand owners are looking for an affordable solution to go green to lower their environmental impact and the carbon footprint of their products. Companies and consumers alike are looking for products that embrace the circular economy. Using wood fibre-based biocomposites, such as Stora Enso's DuraSense, helps in gradually changing the take-make-dispose lifestyle into a more sustainable one."

Stora Enso says DuraSense provides the mouldability and flexibility of plastics with the strength and natural feel of wood. "It behaves similarly to plastic; its density is better than even that of bioplastics," says Oddshammar. "DuraSense biocomposites offer a good entry point for savings in weight and cost. Brand owners can use existing moulds and apply their usual processes, packaging lines, and supply chain optimisation. Customers need to understand the kinds of plastic materials they use, so that matching the required specifications goes as smoothly as possible. We are able to provide technical support during customer trials and facilitate production during a pilot set-up."

**Natural capacity**

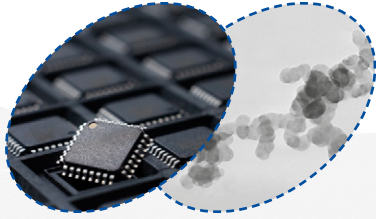
Stora Enso says it has invested in capacity that is far bigger than most other natural fibre compounders. "We have the largest equipment in Europe to produce wood fibre-based biocomposites," says Oddshammar. "This gives us the ability to develop the process further and optimise costs. Ensuring high-quality drying systems is crucial and so is a flexible set-up. We are also broadening our biocomposites raw material base for the milling of large fibres. This means that we will be able to provide a greater choice of technical properties and selection of fibres for biocomposites and offer



PHOTO: SCION

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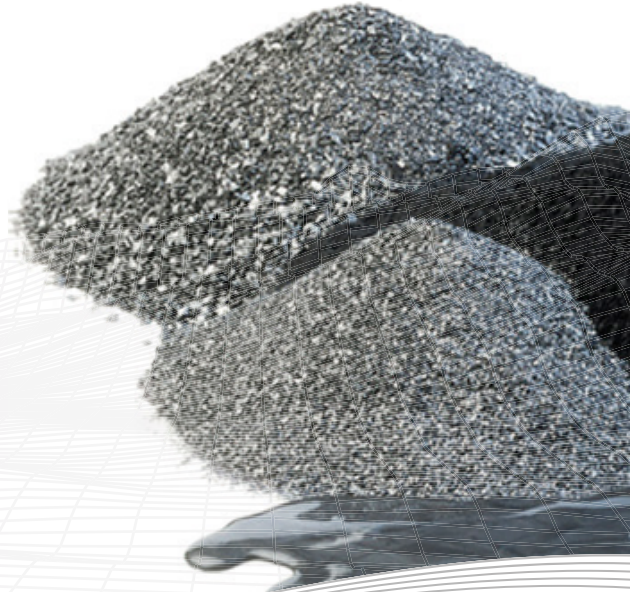
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**Above: Akvila is using Stora Enso's DuraSense biocomposite in place of PS for cutlery**

an attractive price position compared to traditional plastics. This will make it easier for customers to switch from existing material solutions to those based on biocomposites."

The company recently worked with **Orthex Group** to launch a bio-based kitchen utensils range, including cutting boards and kitchen tools. In addition, **Akvila** has used DuraSense to replace polystyrene in disposable and multi-use cutlery. Other applications include furniture, consumer goods and logistic solutions. Stora Enso has also developed a biocomposite material suitable for 3D printing, which has been used to manufacture a complex, round window profile. A further application is stable profiles - a solid wood core covered by a biocomposite skin - providing the necessary strength properties to sustain horse kicks and offering low maintenance and cleaning requirements.

Biocomposites are experiencing a significant increase in market demand, according to Dr Asta Partanen, Senior Researcher at the **Nova-Institut**. "Consumers and industrial customers are asking for materials and products with a low environmental impact, reduced carbon footprint and a lower share of fossil-based plastics," she says. "This development entails a higher use of wood and natural fibres with traditional or bio-based polymers."

Partanen says the biocomposite markets continue to grow, both in established areas such as construction and automotive, as well as in the new market of consumer goods and packaging with new players providing opportunities in innovative applications. Nova Institut estimates that more than 30 compounding companies produced over 100,000 tonnes of granulates with wood and natural fibres in Europe in 2018. It predicts that the market volume of biocomposite granulates in Europe will near double over the next ten years.

"With the latest advances in injection moulding and 3D printing, wood plastic composites (WPC) and natural fibres composites (NFC) are now of great interest for a number of applications. Wood and natural fibre plastic granulates are being specified for consumer goods such as instruments, electronic casings, furniture, tables, toys, combs and trays. The unique look and haptics convey high quality and value and are well received by customers. There are many opportunities for these niche materials to achieve large-scale production soon," she says.

**Automotive potential**

**APM - Automotive Performance Materials** is expanding the use of compounds made with natural fibres in the automotive sector. "For the automotive market, the main driver is weight reduction," says Jean-Marie Bourgeois-Jacquet, Sales & Business Development. "The use of natural fibres instead of mineral fillers permit reduced density and injection of thinner parts, with a weight reduction of up to 25%. Current issues affecting the use of natural fibres in compounds include the need to control the value chain and product quality. Technically, the injection parameters of these compounds need to be controlled. The material needs to be dry before injection, and injected at a lower temperature to prevent fibre burning. The handling of natural fibres is a specific

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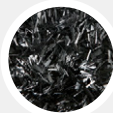
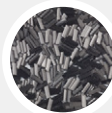


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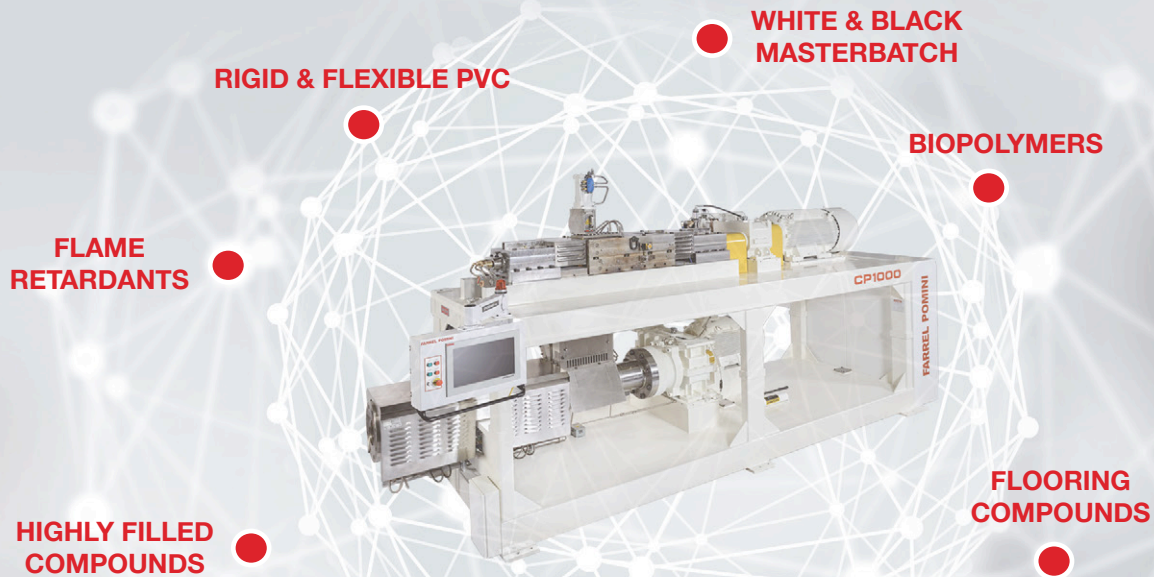
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**Right:**  
**NAFilean is a natural fibre polypropylene material containing 20% short fibres aimed at automotive applications**

part of our know-how, achieved through integration with the agricultural part of the value chain.”  
 APM has developed NAFilean, a natural fibre polypropylene material with 20% short fibres. The company says that end-of-life recycling has been validated and it can be separated and valorised in PP recycling, unlike PP with long glass fibres. Density is 0.98 and it can be processed on traditional injection moulding machines. The material is said to offer high stiffness while ageing performance is appropriate for technical automotive plastic parts. Recent applications include the instrument panel and door panels on the new Peugeot 508 and instrument panel on the Alfa Romeo Giulia. On the latter, the thin-wall moulded part weighs 3.5 kg, representing a saving of 1.05 kg (23%) over a PE-LGF alternative.

Natural fibre compounds are finding their way into new application areas in consumer goods and furniture, although volumes are smaller than in construction or automotive where their use is more widespread, observes Ali Halin, Research Professor at the **VTT Technical Research Centre** of Finland. He outlines a number of influences driving new developments in natural fibres and their use in plastics compounds. These include fashion in construction and furniture, cost and weight reduction in automotive, and new recyclability and biodegradability requirements. There are also new fibres being used, such as hemp, and side products from other industries are also bringing new fibrous materials to plastic composites.

**Treatment techniques**

Problems requiring new solutions in natural fibre composites include density when compared to actual mechanical properties and moisture sensitivity, which can limit their applications, he says. In addition, the compounding of long fibre compos-

**Below:**  
**NAFilean biocomposite is used in a number of applications (marked in green in the latest version of the Peugeot 508)**



PHOTO: AUTOMOTIVE PERFORMANCE MATERIALS (APM)

ites, including flax or hemp for example, requires novel treatment techniques for the fibres. Other current areas of development include efficient and affordable refining of natural fibres, as well as new mechanical and chemical pre-treatment methods for fibres to provide better compatibility with polymers and improved properties.

Halin says that alternative technologies could be employed to solve these issues with natural fibres, such as pultrusion or the use of short residence time compounders such as radial and conical extruders. VTT has also developed a novel densifying method for fluffy materials - the VTT compacting method - as well as compounding methods for long fibres and plastics. It also has the VTT Modix-technique, which involves the use of a single screw extruder with a hollow rotor member.

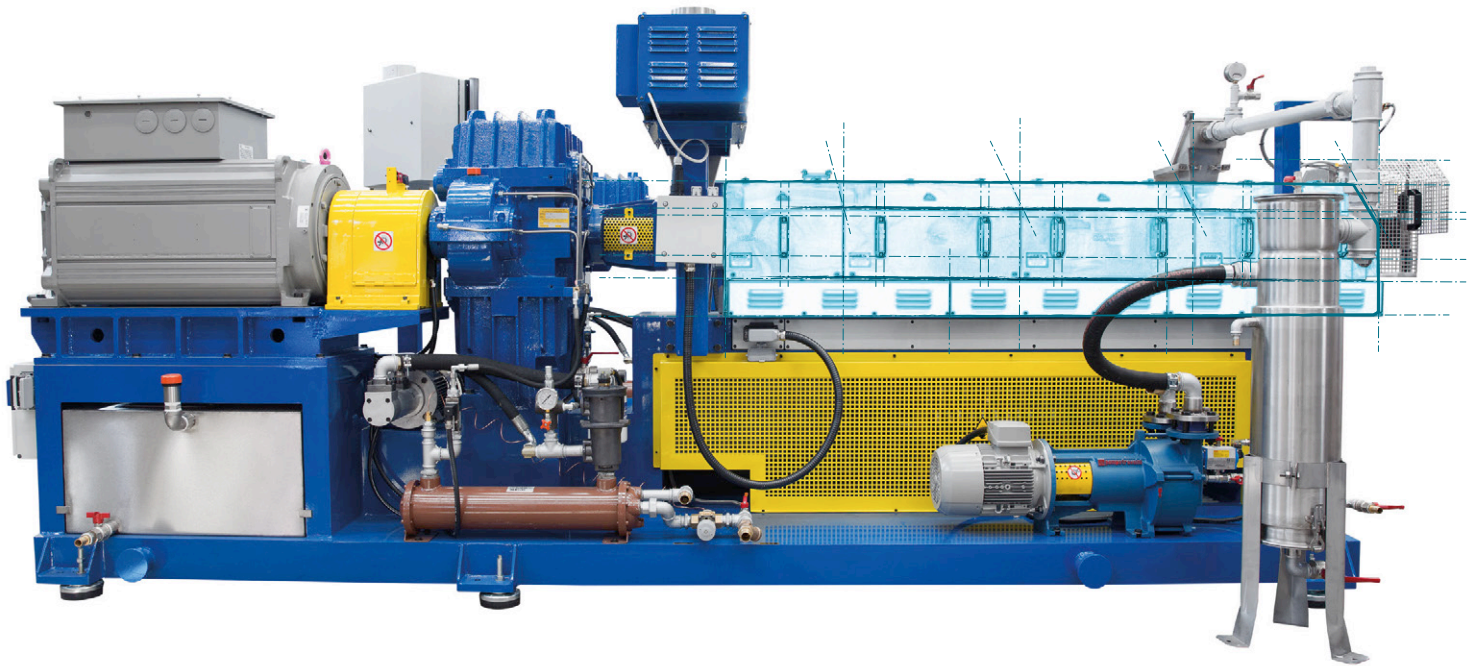
On the materials front, VTT has developed a PLA-cellulose composite material suitable for furniture and mono-material composites as well as extrusion foamed biocomposite materials that combine the stiffness of natural fibres and light weight of foamed plastic. Applications for the latter include heat and noise insulation and impact resistance. Future areas of development include functional/active fibre foam composites, new high performance modified/man-made natural fibres, full recycling of natural fibre composites, and cellulosic materials/composites for different applications for 3D printing and films, for example.

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

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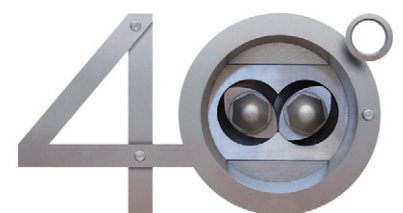
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PHOTO: PROTEC POLYMER PROCESSING

**Main image: The 30m long ProTec LFT line installed at the Suzhou plant of Chinese compounder Suzhou Hechang Polymeric Materials (HCJH)**

# China's HCJH targets LFTs



PHOTO: PROTEC POLYMER PROCESSING

*Suzhou Hechang Polymeric Materials (HCJH)'s recent investment in a ProTec LFT production line is helping it meet the demands of local automotive firms, writes Karin Luxem\**

Chinese-based compounder Suzhou Hechang Polymeric Materials (HCJH) manufactures a range of engineering and LFT compounds at its production plant at Suzhou, in Jiangsu province. The company, which was established around 25 years ago and generates sales of more than RMB610m (€80m), has been running an LFT production line supplied by ProTec Polymer Processing for the past 18 months supplying to customers in the automotive and appliance industries.

The focus of the HCJH compounding business is on custom solutions for specific customer applications. It holds 35 patents and around 60 of its 220 staff are employed in technical roles, many in its on-site R&D centre. "We compound polymers to create novel, high quality materials which are innovative and environmentally friendly", says Vice General Manager Shi Yaoqi. "At present, we are focusing on lightweight and heat-resistant materials and long fibre reinforced plastics."

The company installed the ProTec line to increase its LFT production capacity. Commissioned in the spring of 2017 and in full production by the late summer, the 64-strand line has a throughput of up to 1,000 kg/h, depending on the recipe, and has near doubled HCJH's LFT produc-

tion capacity. It was supplied with a Somos Gramix gravimetric dosing and mixing system, also supplied by ProTec, and was integrated with an existing extruder.

HCJH is currently using the line to produce PP/glass fibre LFTs primarily for automotive sector customers producing structural parts such as front-end modules, instrument panel carriers and sliding roof frames. Fibre lengths correspond to the pellet length, which is typically 10 to 12 mm, and the line can handle glass fibre contents of up to 65% (HCJH is currently producing 30, 40 and 50% commercial products).

"We were looking for a line capable of combining high speed production with good pellet quality", says Yaoqi. "Top quality is crucial on the Chinese LFT market, in particular for our customers in the automotive and household appliance industries."

As standard, a ProTec LFT line consists of a creel unit that holds and simultaneously unwinds a number of fibre bobbins, a chucking

**Above: Detail of the one tonne per hour HCJH line showing the creel carrying the 64 glass reinforcement bobbins**

**Right: HCJH Vice General Manager Shi Yaoqi: focusing on lightweight compounds and LFTs**





**Above: An automotive front-end module produced in LFT-PP**

device with combs for guiding and tensioning the fibre strands, and an extruder for melt preparation. In addition, there is a die for impregnating the fibres with the polymer melt and a water bath for cooling the coated strands. A puller drive unit conveys the fibre strands, which are chopped to length in a pelletiser.

A central control module with touch panel regulates the individual components of the line, for example automatically coordinating them in the event of a variation in line speed or change in pellet chopping length.

The LFT line was adapted to local circumstances for HCJH, for example to the extruder provided by

the customer and to the dimensions of the production shop in Suzhou where the approximately 30 m long line was to be set up. The dosing unit was mounted on the extruder using a special flange to save vertical space.

ProTec integrated the existing extruder control into the line controller to enable retrieval and direct adjustment of rotational speed and temperature via the touch panel.

The controller also stores the extruder parameters for each formulation, which simplifies operation. "The line is very simple to operate and is extremely reliable", says Yaoqi, who emphasises the uniform fibre impregnation it is achieving and the flexibility in formulation and possibility of fully automated operation.

While the line is currently being used to predominantly produce PP LFT grades, HCJH's ongoing R&D activities include development of products based on PA, ABS and PBT matrix resins.

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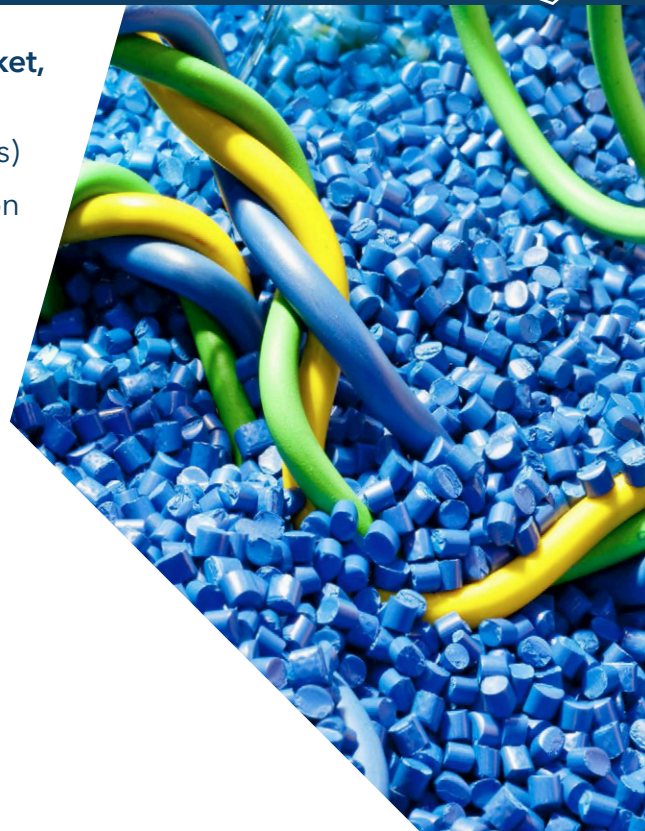
■ Karin Luxem is Area Sales Manager Asia/Pacific at ProTec Polymer Processing [karin.luxem@sp-protec.com](mailto:karin.luxem@sp-protec.com)

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FIND OUT MORE



*Compounding World will be hosting a series of focused conference sessions at the free-to-attend Compounding World Expo in Cleveland, Ohio, in the US in May. We preview the programme*



# Compounding World Expo hosts free US conferences

The speaker line-ups have been revealed for the two free-to-attend conference theatres at the Compounding World Expo 2019, an all-inclusive exhibition and conference event organised by AMI and *Compounding World* magazine at Huntington Convention Center in Cleveland, Ohio, US on 8-9 May 2019. The two theatres, which are sponsored by Sekisui Specialty Chemicals America and by Automotive Compounding Industry (ACI), will host a series of keynotes and technology presentations throughout the two days.

The opening keynote address on the first day of the exhibition will be given by **Andrew Reynolds**, a founder of **AMI** and Director of **Advance Bidco**, the owner of AMI. He will set the scene with a paper analysing global trends in plastics compounding markets. **Sylvia Tabero**, Senior Project Consultant at **AMI Consulting** will give a paper on the global compounding market and perspectives for PP compounds. And on the following day, the opening keynote will be delivered by **Chris Smith**,

Editor of *Compounding World*, who will highlight five compounding innovations to watch.

Across the two days of the conference there will be four separate panel discussions featuring industry leaders debating the future for technical compounds, masterbatch/concentrates, PVC compounds and cable compounds. These will include senior representatives from A Schulman, Alok Masterbatches, Americhem, Aurora Plastics, Champlain Cable, Chroma Color Corporation, Prysmian Group - General Cable, Mexichem Specialty Compounds, Primex Plastics, RTP, Southwire, Techmer PM, TPC Wire & Cable and Westlake Compounds. [CLICK HERE](#) for more details.

The two-day programme will also include six practical training seminars covering topics such as: specifying and optimising compounding lines; designing extensional mixing in extrusion; measuring and controlling colour; formulating better compounds; and understanding polymer degradation and stabilisation. For more details, [CLICK HERE](#). >



Expert speakers at the free-to-attend Compounding World Expo conference include, (top row from left to right), Shamrock Technologies R&D Manager **Dr HyunSeog Kim**, IMI FABI Product and Application Development Specialist



**Piergiovanni Ercoli Malacari**, Wacker Chemical Corporation Technical Manager **Dr Daniel Calimente**, Polyscope Polymers Sales and Business Development Manager **Ardy Doelen**, Nanoxplore Product Development Manager **Dr Nima Moghimian**, Bekaert Fiber Technologies Global Market Manager **Conductive Plastics Tom Daniëls**, Unipetrol RPA - Polymer Institute Brno Researcher **Jakub Olšan**, (bottom row from left to right) Milliken Business Development Manager **Emily Blair**, Fine-Blend Compatibilizer R&D Market Development Manager **Duan Hao**, Coperion Director of Process Technology **Sabine Schönfeld**, ENTEK Extruders Design Engineer **Melissa Jensen-Morgan**, and Buss USA National Sales Manager **Dana Pulvino**

### Technology in focus

In between the business debates and training seminars, there will be more than 25 presentations covering the latest technology developments. A number of these technical presentations will be focused on optimising formulations and adding functionality. **Dr HyunSeog Kim**, R&D Manager at **Shamrock Technologies** in the US, will discuss improving the wear-resistance of plastics and detail advances in PTFE micropowders and developments in non-halogen additives. **Piergiovanni Ercoli Malacari**, Product and Application Development at **IMI FABI** in Italy, will detail lightweighting strategies using talc in automotive TPOs. And **Alexander Kulichenko**, Technical Director at **Europiren** in the Netherlands, will speak about optimised magnesium hydroxide as a flame retardant for building and construction compounds.

The role of silicones as high-performance additives will be explored by **Dr Daniel Calimente**, Technical Manager at **Wacker Chemical Corporation** in the US. **Dr Rob Lorenzini**, Technology Manager at **Maroon Group** in the US, will speak about innovations in high-performance thermal stabilisation and VOC-scavenging solutions for polyolefins and engineering resins. **Ardy Doelen**, Sales and Business Development Manager at **Polyscope Polymers** in the Netherlands, will explore progress in optimisation of engineering plastics blends. And **Dr Nima Moghimian**, Product Development Manager at **NanoXplore** in Canada, will assess process-induced properties of graphene-polyethylene nanocomposites.

Another important technology topic to be covered in the theatres will be electrically and thermally conductive compounds. **Rijo Jacob Robin**, Technical Product Manager at **Superior Graphite** in the US, will discuss developments in resilient carbon fillers for improving wear resistance and thermal conductivity. Advances in metal fibres for enhancing the conductivity of plastic compounds will be explored by **Tom Daniëls**, Global Market Manager **Conductive Plastics** at **Bekaert Fiber Technologies** in Belgium. And **Jakub Olšan**, Researcher at **Unipetrol RPA - Polymer Institute Brno** in the Czech Republic, will speak about tailoring of electrical conductivity of thermoplastics using carbon black masterbatches.

Some of the technical papers will focus on reinforcement innovations. **Alex Walk**, Product and Technology Development Manager at **SGL Carbon** in the US, will discuss current and future use of carbon fibre reinforced plastics in automotive applications. And **Dr Ashok M Adur**, Global Commercial Development Director **Plastics** at **Vertellus** in the US, will cover surface chemistry modification as a method to improve the performance of polyamide compounds reinforced with glass fibres and other functional additives.

### Sustainable developments

With sustainability becoming such an important issue, several presentations will focus on technical innovations in the use and development of recycled plastics and sustainable materials. **Emily Blair**, Business Development Manager at **Milliken**

in the US, will detail compounding options to enhance properties of recycled PP resins. **Duan Hao**, R&D Market Development Manager at **Fine-Blend Compatibilizer** in China, will detail the use of chain extenders to improve performance of recycled PET. And **Domenic DiMondo**, VP Technology and Business Development at **GreenMantra Technologies** in Canada, will detail progress in the development of sustainable polymer additives from recycled feedstocks.

Production technologies and process optimisation will be key themes across the two conference theatres. **Sabine Schönfeld**, Director of Process Technology at **Coperion** in the US, will provide some practical tips for effective production of TPEs on twin screw compounding equipment. **Dr Haikun Xu**, Process Engineer at **KraussMaffei Corporation** in the US will present a study of mixing performance of low shear screw elements on high speed compounding lines. **Melissa Jensen-Morgan**, Design Engineer at **ENTEK Extruders** in the US, will provide some useful tips for speeding up product changeovers. And **Ivano Lanzetta**, Area Sales Manager at **Maris** in Italy, will discuss optimised twin screw compounding of highly filled products.

Technology for production of long-fibre thermoplastics (LFTs) will be covered by **Sebastian Jost**, Manager of Design and Engineering at **Feddem** in Germany. The newest developments in kneader technology for production of challenging compounds will be detailed by **Dana Pulvino**, National Sales Manager at **Buss USA**. Then **Ed Ford**, Sales Manager Plastics Plant North America at **Zeppelin Systems USA**, will speak about the latest feeding solutions for compounding installations. And **Laurent Ratte**, Sales Manager at **Sciences Computers Consultants** in France, will explain how mathematical modelling can help develop new compounding processes and simulate behaviour of different polymers and additives.

**Patrick Lahmann**, Sales Engineer at **Farrel Corporation** in the US, will present some case

studies showing how continuous mixers have been used effectively to process PVC, HFFR and PLA compounds. And **Slayton Altenburg**, Application Specialist at **TPEI** in the US, will detail the application of continuous mixing technology in production of highly filled compounds.

### Put to the test

The conference sessions will also cover the important area of testing and analysis. **Dr Yanxi Zhang**, Technical Sales Support at **Netzsch Instruments North America**, will explain how thermal analysis can be used to characterise recycled polymer compounds. And **Brian Birmingham**, Business Development Engineer at **Sikora** in the US, will detail how optical inspection and automated analysis can be applied to monitor and control pellet quality.

The full Compounding World Expo conference programme, including timings, can be downloaded [HERE](#). It covers both the conference streams running over the two days, including the more than 25 technology presentations as well as the two keynotes, four business debates and six training seminars.

Your **FREE TICKET** for the Compounding World Expo will also provide free admission to the co-located Plastics Recycling World Expo and Plastic Extrusion World Expo exhibitions and conference theatres. The three Expos will feature more than 230 exhibitors from around the world including a wide range of suppliers of processing machinery, auxiliary equipment, raw materials, additives, and related products and services.

Exhibitors include Addivant/SI Group, Aditya Birla, Aesse, Alok Masterbatches, Apex Engineering, Azo, BASF, B&P Littleford, Bay Plastics Machinery, Bekaert, BPC Toll Compounding, Brabender Technologie, Brenntag, Buss, BYK, Cabot, Chemours, Clariant, Coperion, CPM Extrusion Group, CW Brabender Instruments, Davis-Standard, Dover Chemicals, Dr Collin, Econ, ENTEK, Erema, Farrel, Ferro, Gneuss, Harwick Standard, Heritage Plastics,

## Compounding World Expo 2019

The free-to-attend Compounding World Expo exhibition and conference will be held at the Huntington Convention Centre in Cleveland, Ohio, US, on 8-9 May 2019. The event brings together the entire compounding industry value chain and runs alongside the Plastics Recycling World Expo and the Plastics Extrusion World Expo. More than 230 exhibitors are already signed up for the event, which will be one of the biggest plastics industry exhibitions in North America in 2019. Attendees can also sign up and network at an after-show party at Cleveland's iconic Rock and Roll Hall of Fame.

You can register for your free pass, which provides access to all three exhibitions and their associated conference streams, using the online registration form: [www.ami.ltd/Register-AMI-Expos](http://www.ami.ltd/Register-AMI-Expos)



## New names sign up for concentrates debate

Two more leading industry figures have joined the masterbatch/concentrates business debate, which will be held at the Compounding World Expo in Cleveland, Ohio, US on 9 May. **Doug Borgsdorf**, Business Director at **Primex Plastics** in the US and **Tom Bolger**, President and CEO at **Chroma Corporation** in the US, join **Matthew Hellstern**, CEO at **Americhem** in the US, **Deepak Parikh**, Region President & CEO - USA and Canada at Clariant Corporation; and **Amit Puri**, Owner & Director Marketing, **Alok Masterbatches** in India. The panel discussion will be chaired by **Andrew Reynolds**, Director of **Advance Bidco** (owner of AMI).

**New additions to the free-to-attend masterbatch/concentrates business debate at the Compounding World Expo in Cleveland in the US in May include, from left, Primex Plastics Business Director Doug Borgsdorf and Chroma Color Corporation President and CEO Tom Bolger**



JSW, Kaneka, Kisuma, Konica Minolta, KraussMaffei, Labtech Engineering, Lanier Color, Leistritz, Lubrizol, Maag, Maguire, Maris, Maroon, Milliken, Mitsui Chemicals, Mixaco, Modern Dispersions, Netzsch, NFM, Nordson, Omya, Opticolor, Orion, Plasmec, PolyOne, Polyscope, Promixon, QLab, Schenck Process, Sekisui Chemical, SGL Carbon, Shamrock, Sikora, Steer, Struktol, Thermo Fisher, TPEI, Unipetrol, Vertellus, Wacker, Zeppelin, Zoltek and many more.

Rita Andrews, Head of Exhibitions at AMI says: "The Cleveland exhibitions will provide visitors with a great opportunity to learn about the latest products, find new suppliers, and negotiate deals. In addition, the conference sessions will provide the perfect place to discover innovative technologies and industry best practices".

The limited number of remaining booths are being filled on a daily basis. To find out more about exhibiting at any of the expos, visit <https://www.ami.international/exhibitions>. Or to book your free visitor ticket, which is valid for both days of the event and includes access to all three exhibitions and their respective conference theatres, visit: [ami.ltd/Register-AMI-Expos](http://ami.ltd/Register-AMI-Expos)

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# Simulation aids compounding success

*Increasingly accurate tools are now available to model the compounding process and to predict the outcome of changes in materials and operating conditions. Mark Holmes looks at some of the latest options*

Advances in computer modelling software can now lead to accurate simulation of the compounding process, saving time and money in the laboratory and allowing the outcome of process changes to be accurately predicted and successfully implemented.

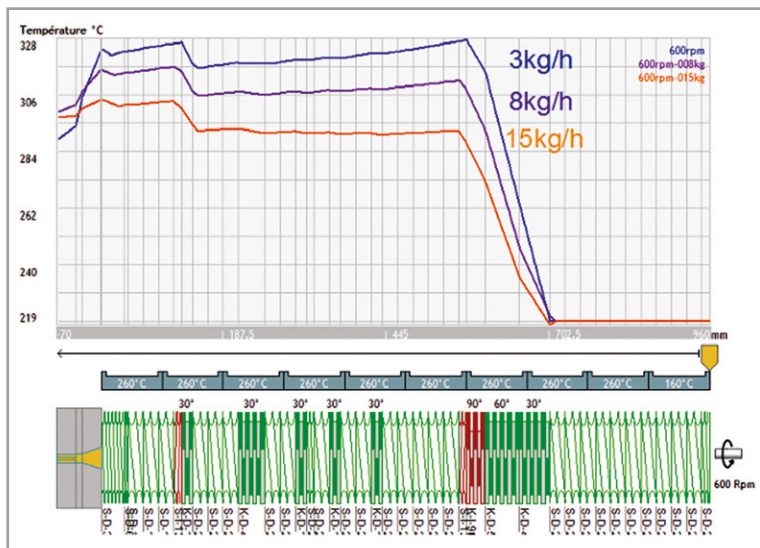
There are several principal requirements for computer modelling software for the compounding process, according to Adam Dreiblatt, Director Process Technology at **CPM Extrusion Group**. "These include the flexibility to adapt to multiple machine geometry platforms," he says. "In addition, software requires the ability to 'calibrate' or tune a model to actual process conditions. It needs to be user-friendly and be a good predictor of product quality, dispersion and mixing."

Dreiblatt says that the compounding industry can benefit from simulation software because of the need to deal with increased energy, raw material and labour costs, which is often intensified by the move to smaller lot sizes and the need to maximise yield. Compared to running trials on a production line, simulation software offers a cost effective alternative and simulation tools are becoming standard practice in multiple industries facing the same cost pressures.

However, he says there are some new applications that could still benefit from advances in modelling techniques. These include reactive extrusion; there are many different reactions possible in a twin screw extruder and it is not possible to create a 'generic' reaction module. This requires incorporation of reaction kinetics to predict conversion efficiency and this kind of information is not generally available. Peroxide degradation is another example, he says, while other types of reaction are a function of time, temperature, shear, mixing and composition - too many variables.

Other areas of development in simulation software include ensuring the output of simulation is directly related to the characterisation of raw materials - this is a big challenge to widespread use of existing software programs. The information required for raw materials - such as polymers, additives and fillers - is extensive and is not generally available to the compounding industry in the way that similar information is available for injection moulding software such as Moldflow, says Dreiblatt. Making simulation software available to the compounding industry through, for example 'pay-per-view', is being explored at present. ➤

**Main image:**  
**Simulation technology allows process development to be taken off-line, saving time, money and material**



**Figure 1: Change in material temperature calculated for different throughputs** *Image: SC-Consultants*

However, disclosure of confidential information, such as screw configuration and formulation, will be required.

The performance of computational fluid dynamics (CFD) is getting better with new software developments and faster hardware, says Markus Schumde, Head of Research & Development at **Coperion**. "Therefore, developing and using CFD methods to calculate flow patterns inside twin screw extruders is an efficient way to investigate the working principle or performance of screw elements, in particular during the development phase," he says, adding that simulation can reduce cost intensive and complex testing in the laboratory.

"Coperion showed during its Extrusion Days 2018 a comparison between simulation and reality using a transparent ZSK 58 twin screw extruder. The accuracy of the state-of-the-art simulation methods is high and represents the reality very well. A key issue is transferring the set-up and boundary conditions of the experiment in every detail into the simulation or the other way around. Only then can satisfying results be expected," Schumde says.

Over the past 15 years, the compounding industry has increasing been looking for higher levels of performance in reinforced, lightweight and environmentally-friendly materials, says Laurent Ratte, Sales Manager at **Sciences Computers Consultants (SC-Consultants)**. "As material formulation gets more complex, the twin screw

extrusion process has to be able to achieve the required mixing levels to process these materials. Moreover, as the twin screw extruder offers many operating options, the process can be seen as a black box. Simulation is therefore a powerful tool for opening the box and understanding the relationships between geometry, operating conditions, materials and mixing efficiency," he explains.

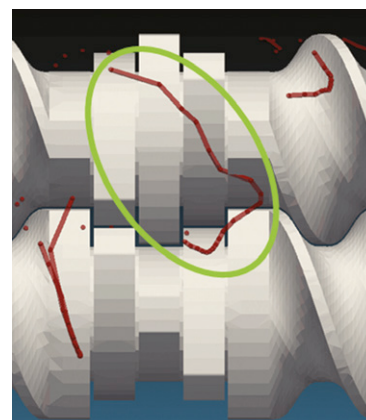
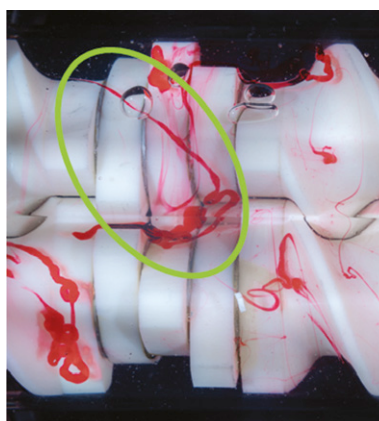
"In compounding, three components are essential to ensure the quality of the final product - machine geometry, materials and the operating conditions. In real life through tests and trials, it is not always necessary to explicitly know and understand the physics involved in the process - it either works or it does not. However, simulation needs data to evaluate the process without actual tests and is key for the quality of the modelling," he says. Ratte says that using current simulation software it is now possible to provide highly predictable results (Figure 1).

**Data accuracy**

The issue of data input is particularly relevant for material characterisation. "As products and formulations become more complex and the process can include liquids, gases, additives, fillers and reactions, the data have to be accurate enough for providing appropriate solutions," says Ratte. "However, with some numerical experience, it is also worth running a simulation even without a complete and validated set of input data. With correct methodology, the simulation can provide valuable qualitative information with a trend analysis approach."

SC-Consultants adds that modelling software offers the compounding industry a number of advantages, including a reduction in time to market.

Simulation is a fast tool for adapting a product on a new line, and for defining an appropriate operating domain such as flow rate and rpm, for



**Above and right: Actual results obtained using dye in a transparent ZSK58 extruder (above) compare well with simulation outputs (right)**

PHOTO: COPERION



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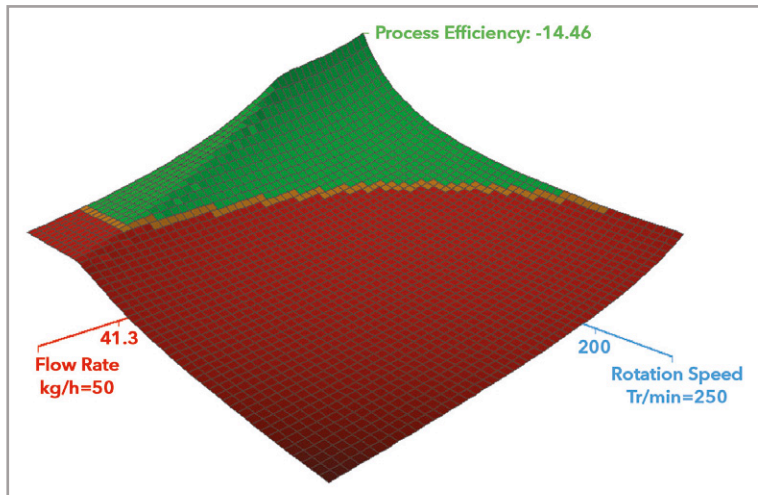
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A DoE map for a set of around 100 parameters calculated using the Ludovic software

Image: SC-Consultants

instance, for a given combination of machine and recipe. Screw design becomes an easier task with the support of simulation, as it can provide a good understanding of the mechanical relationships between geometry, materials and operating conditions. In addition, it can assist homogenisation of multi-site production between different sites and machines. Simulation can also be used to re-engineer recipes due to regulatory constraints (REACH) or machine and formulation changes.

Development of simulation tools are market driven. "As the main issue in the compounding industry is to realise high-performance products, modelling software has to embrace this challenge," says Ratte. "From an industrial point of view, this challenge is complicated by ever more complex formulations - the days of a simple polymer matrix are gone. Most current compound formulations are made of a lower matrix part, with the proportion of fillers and additives increasing. It is now common to deal with polymers with a filler ratio of 55-60% or higher."

In order to meet these issues, Ratte says that

modelling software developers have needed to adapt strategies and models to take these changing formulations into account. This has involved the adaptation of rheological models and the integration of solid or liquid fillers to represent their impact on the material flow.

**Technical solutions**

"These trends have resulted in changes, but also opened new markets. The technical compound market remains the principal target for simulation. However, masterbatches with their high filling loads are now a credible application, particularly with the development of solid particle behaviour modelling," he says. "In addition, as the twin screw extruder is further improved and re-discovered, increasingly it is being used as a continuous reactor. In these cases, the combination of mixing, temperature and residence time is used for initiating a chemical reaction. This reaction is required for providing specific properties and structures to the material, such as grafting and controlled degradation. Sometimes, chemical reactions take place when they are not welcome and they degrade the material. As a result, the use of modelling is valuable in controlling, adjusting or preventing the initiation of a reaction."

In modelling the compounding process, the main questions that arise are about the material and the geometry. "For the material, standard analytical laws used for defining the mechanical behaviour of a material are not enough," Ratte adds. "User's laws have therefore also been developed to take into account thermal or shear sensitivity, for example. In addition, as twin screw extruder manufacturers develop new screw elements, these have to be integrated into the modelling software to take into account their impact on the material flow. Typically, the non-self-wiping elements of these new screws are the ones requiring re-written modelling equations. Such

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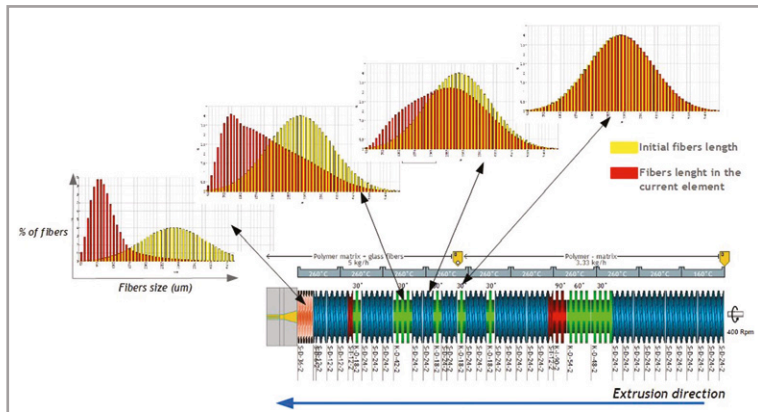
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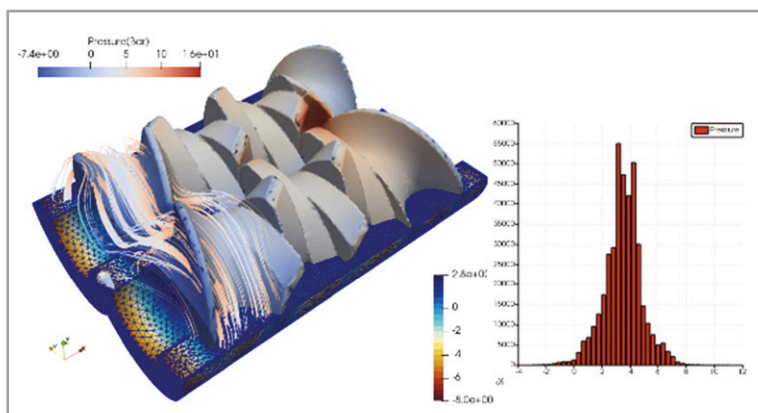


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**Figure 3: Simulated prediction of glass fibre length change throughout the processing unit**

Image: SC-Consultants



**Figure 4: Pressure distribution simulation in a twin screw extrusion mixing zone**

Image: SC-Consultants

elements can be easily simulated in three dimensions, but for the simpler one-dimensional model, this has meant a real challenge and adaptation.”

To meet these objectives, SC-Consultants is this year introducing two new software packages for compounding applications. The first of these is the Ludovic i1D software, which can run a computation in less than 15 seconds for predicting global process trends.

Ludovic can be used for proposing sensitivity analysis of the material, as well as quickly defining and adapting operating windows, taking into account the machine and product. The software also incorporates a DoE (Design of Experiments) wizard to automatically identify an operating domain for a set of around 100 parameters, such as screw profile and process conditions (Figure 2).

**Fibre simulation**

SC-Consultants adds that as solid fibres are often involved, the Ludovic software is equipped with a specific module for computing glass fibre length during process evolution. As their final length is a key factor, particularly for reinforcing polymers, the

process conditions and screw design have to be carefully designed in order to minimise shear and pressure areas to preserve the fibres. This can be achieved with the support of simulation (Figure 3).

For localised analysis, the company has also developed XimeX-TSE software to provide a complete 3D CFD analysis of a specific area of the twin screw. The objective is to quantify the mixing efficiency of a reduced section of the machine and, through experimentation, zones of interest can be isolated. Analysing real material flow is not easy, which is why in modelling a zoom is used for measuring phenomena that apply to the mixing efficiency zone. Local residence time, local shear distribution or particle elongation and distribution are computed for, providing information about the level of mixing reached in each studied area (Figure 4).

In one recent project, SC-Consultants conducted a validation campaign for a solid wood filler to test its behaviour with different polymers and on different machines. One of the targets was to identify the maximum authorised product temperature and the specific mechanical energy required for the machine to ensure good dispersion of the material. This was achieved with the Ludovic software, using an automatic DoE for identifying a complete functioning domain (screw speed versus flow rate) on different extruders. The software helped reduce the number of trials originally specified by half and so also reduced time to market.

“All SC-Consultants developments are industry-driven projects,” Ratte adds. “From a global analysis point of view, we focus on material behaviour to improve the understanding and analysis of complex formulations. In the latest developments, solid particle erosion and new reaction rules have been included in the Ludovic software. Future developments will involve projects on liquid additives, gas injection and new mixing laws.”

Process know-how is essential for developing accurate modelling software, according to Frederik Sporkmann of the Plastics Technology Institute (KTP) of the **Paderborn University** in Germany. “Some software products are well programmed regarding their user interface and user experience. However, at the end of the day it comes down to what predicts the process as well as possible. This is particularly the case with a complex system like a compounding process,” he says.

“Processes are getting more complex. The growth in lightweight design and e-mobility requires new material compounds and adapted processes. If the plastic is substituting material like steel, then in the long run it has to be optimised for

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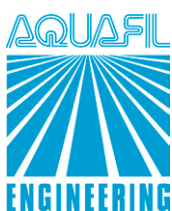
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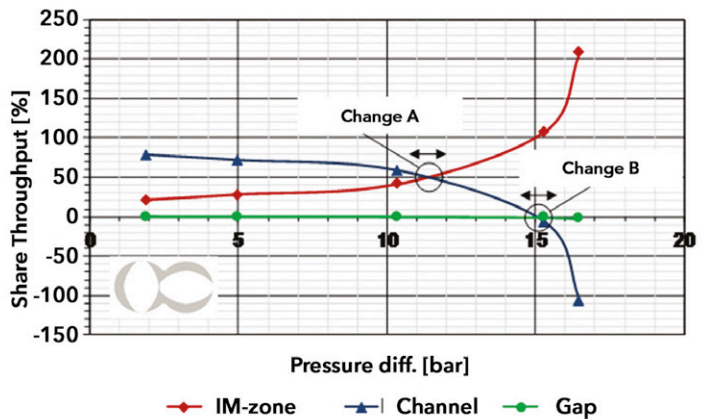
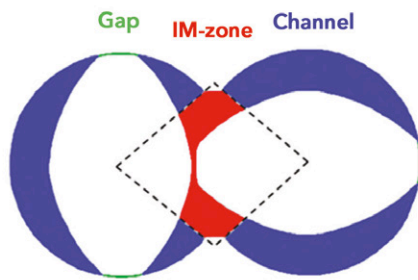
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**Figure 5:**  
Visualisation of throughput-pressure behaviour of different flow areas in a conveying two-flighted screw element

Image: KTP/  
Paderborn  
University



its application. That means each application has its own needs for a special compound. Simulation software can decrease experimental effort to develop new compounds immensely,” according to Sporkmann.

“Areas of current development in modelling software include dealing with compounds containing high levels of fillers and additives. Compounds can now have filler contents of up to 70-80%. An example is polyamide with 70% steel powder. In addition, there is work underway to make a connection between an integral solution provided by one-dimensional software which can describe the whole process, with highly detailed solutions provided by localised numerical simulations. SIGMA3D is an interface which allows the combination of solutions by numerical simulation with the one-dimensional process simulation - providing the best of both worlds. The whole system is simulated quickly and easily with one-dimensional algorithms, while for detailed insight, such as dead zones in screw elements, the numerical software will give local solutions for the user.”

The KTP Plastics Technology Institute uses SIGMA3D for detailed input to its 1D SIGMA modelling software for simulation and calculation of compounding processes. The University says that after the successful introduction of SIGMA3D in the past year, further work was done on the development of the SIGMA3D module. In terms of Industry 4.0 and associated customer demands for intelligent and digitally networked systems, SIGMA3D was successfully implemented in SIGMA.

The KTP says that it has realised an automatic data exchange between both programs and developed a user-friendly interface. The interface allows networking of the advantages of the numerical calculation with the advantages of the analytical calculation of SIGMA1D in one program. The analytical approach in SIGMA1D enables the calculation of the boundary conditions of the entire

extrusion process. For example, this includes the melting or pressure curve over the entire screw length. SIGMA3D extends the 1D model with exact numerical observation of individual screw elements.

### Filled elements

The CFD model describes up to three fully filled elements in one calculation and can be used for isothermal and non-isothermal calculations of shear-thinning polymer compounds. Based on the 3D data, it is possible to determine local material loads. For example, possible applications are the determination of flow characteristics such as dead zones or wall slipping in mixing elements. SIGMA3D can simulate materials with low to high viscosity within a practical range of the process parameters that are commonly used in industry with good accuracy. In the SIGMA3D module, the data are then automatically fed into KTP’s SIGMA1D software for visualisation of the whole system.

Additional work is planned on the speed of the interfaces and on Windows compatibility in order to improve user-friendliness. This also includes the development of the direct visualisation of the throughput-pressure behaviour of different flow areas, for example the intermeshing zone (IM-zone) of a conveying two-flighted screw element, in the SIGMA3D-interface (Figure 5).

The KTP adds that SIGMA software is continually improved through a series of two-year projects with industrial partners. The current project cycle, SIGMA12, started in March 2018, and the goals for project development were determined by the project committee.

Another topic undertaken by the KTP last year was the incorporation of three-flighted eccentric kneading elements into the SIGMA database. Due to today’s requirements of high-performance extrusion, these are increasingly being substituted for conventional two-flighted kneading elements (three-flighted eccentric kneading elements are

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often used in large volume machines and benefit from a favourable feed angle). The KTP developed a complete parametrical description of three-flight-kneading elements and implemented it for application in SIGMA (Figure 6).

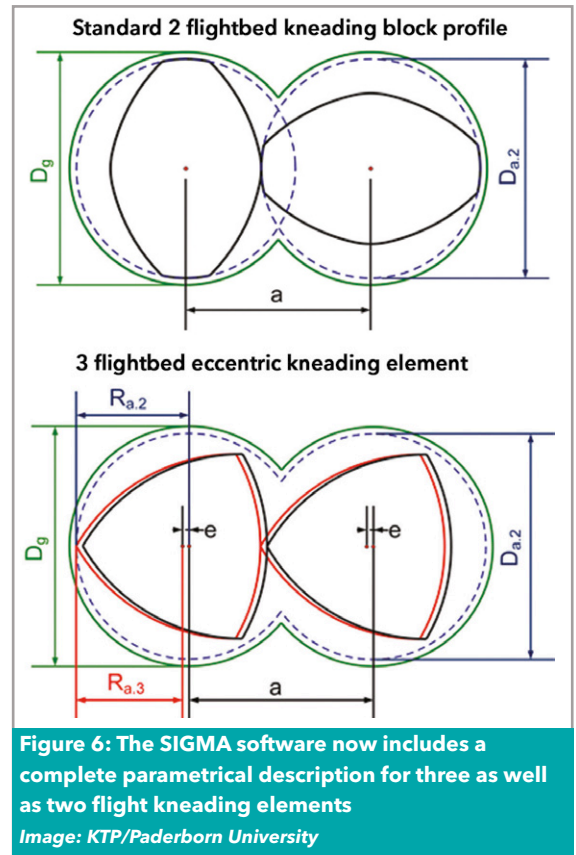
**Carbon visualisation**

The KTP adds that another important topic at the moment is the processing of carbon fibre recycles in the compounding process. It has therefore developed a model to visualise the process in SIGMA. In the future, it will be possible to calculate the fibre length distribution over the entire screw length in SIGMA for both recycles and newly produced fibres.

In addition, a developmental power calculation module will shortly make it possible for the user to output the exact power requirement and required torque for the screws with the software.

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## THEATER 1 - DAY 1

- 9:30 - 10:00 KEYNOTE PRESENTATION: Analyzing global trends in plastics compounding markets**  
Andrew Reynolds, Director  
ADVANCE BIDCO (owner of AMI)
- 
- 10:15 - 11:00 BUSINESS DEBATE: Discussing the future of technical compounding. Chaired by Chris Smith, Editor, Compounding World, AMI**  
Tom Drye, Vice President Emerging Markets & Innovation, TECHMER PM • Jean Sirois, MD of Strategic Planning and Acquisitions/GM Canada, RTP COMPANY • Frank Roederer, Senior Vice President Engineering Composites, A. SCHULMAN
- 
- 11:10 - 11:30 Useful tips for the production of thermoplastic elastomers on twin-screw compounding**  
Sabine Schönfeld, Director Process Technology  
COPERION
- 11:40 - 12:00 Surface chemistry modification to improve the performance of polyamide compounds reinforced with glass fibers and other functional additives**  
Dr. Ashok M. Adur, Global Commercial Development Director, Plastics  
VERTELLUS
- 12:10 - 12:30 Optimizing the production of highly-filled compounds and concentrates using co-rotating twin-screw extruders**  
Ivano Lanzetta, Area Sales Manager  
F.LLI MARIS
- 12:40 - 1:00 Innovative feeding solutions for the future of polymer compounding**  
Ed Ford, Sales Manager - Plastic Plants, North America  
ZEPPELIN SYSTEMS USA
- 1:40 - 2:00 Characterization of recycled polymer compound by thermal analysis**  
Dr. Yanxi Zhang, Technical Sales Support  
NETZSCH INSTRUMENTS NORTH AMERICA
- 2:10 - 2:30 The global compounding market and perspectives for PP compounds**  
Sylvia Tabero, Senior Project Consultant  
AMI CONSULTING
- 
- 2:45 - 3:30 BUSINESS DEBATE: Discussing the future for cable compounds. Chaired by Chris Smith, Editor, Compounding World, AMI**  
Tariq Quadir, Chief Technologist and Senior Scientist, CHAMPLAIN CABLE • Dave Camillo, Chief Engineer Formulations, SOUTHWIRE COMPANY • Eric Bates, Principal Engineer, PRYSMIAN GROUP • Tim Hannigan, Engineered Cable Innovation Manager, TPC WIRE & CABLE CORP.
- 
- 3:40 - 4:00 Developments in resilient carbon fillers to improve wear resistance and thermal conductivity**  
Rijo Jacob Robin, Technical Product Manager  
SUPERIOR GRAPHITE
- 4:10 - 4:30 Compounding case studies - using continuous mixers for the efficient processing of PVC, HFFR and PLA compounds**  
Patrick Lahmann, Sales Engineer  
FARREL CORPORATION

## THEATER 1 - DAY 2

- 9:30 - 10:00 KEYNOTE PRESENTATION: Five compounding innovations to watch**  
Chris Smith, Editor, *Compounding World*  
AMI
- 
- 10:15 - 11:00 BUSINESS DEBATE: Discussing the future for the concentrates industry. Chaired by Andrew Reynolds, Director, ADVANCE BIDCO (owner of AMI)**  
Matthew Hellstern, CEO, AMERICHEM • Deepak Parikh, Region President & CEO - USA and Canada, CLARIANT CORPORATION • Amit Puri, Owner & Director Marketing, ALOK MASTERBATCHES • Doug Borgsdorf, Business Director, PRIMEX PLASTICS • Tom Bolger, President and CEO, CHROMA CORPORATION
- 
- 11:10 - 11:30 Discussing carbon-fiber-reinforced plastics for automotive applications - current use and future methods**  
Alex Walk, Product and Technology Development Manager  
SGL CARBON
- 11:40 - 12:00 Top tips for faster product changeovers**  
Melissa Jensen-Morgan, Design Engineer  
ENTEK EXTRUDERS
- 12:10 - 12:30 Optimizing natural magnesium hydroxide flame retardants to deliver new opportunities for the building and construction industry**  
Alexander Kulichenko, Technical Director  
EUROPIREN
- 12:40 - 1:00 Exploring advances in metal fibers for enhancing the conductivity of plastic compounds**  
Tom Daniëls, Global Market Manager Conductive Plastics  
BEKAERT FIBER TECHNOLOGIES
- 2:10 - 2:30 Innovations in high-performance thermal stabilization and VOC-scavenging solutions for polyolefins and engineering resins**  
Dr. Rob Lorenzini, Technology Manager  
MAROON GROUP
- 
- 2:45 - 3:30 BUSINESS DEBATE: Discussing the future for PVC compounding. Chaired by Sylvia Tabero, Senior Project Consultant, AMI CONSULTING**  
Darrell Hughes, CEO, AURORA PLASTICS • Donald R. Williamson Jr., Director- Compounds, North America, WESTLAKE COMPOUNDS LLC, A WESTLAKE COMPANY • Gautam Nivarthi, Vice President and General Manager Compounds Business Group, MEXICHEM SPECIALTY COMPOUNDS
- 
- 3:40 - 4:00 New trends in compounding - examining how computer simulation can help**  
Laurent Ratte, Sales Manager  
SCIENCES COMPUTERS CONSULTANTS
- 4:10 - 4:30 Using continuous mixers for producing highly-filled compounds - increasing versatility and reducing costs**  
Slayton Altenburg, Application Specialist  
TPEI

## THEATER 2 - DAY 1

- 9:30 - 10:15 TRAINING SEMINAR: How to specify twin-screw extruders for polymer compounding applications**  
Adam Dreiblatt, Director of Process Technology  
CPM EXTRUSION GROUP
- 
- 10:30 - 10:50 Exploring progress in the optimization of engineering plastics blends**  
Ardy Doelen, Sales and Business Development Manager  
POLYSCOPE POLYMERS
- 11:00 - 11:20 Enhancing the properties of recycled polypropylene resins to uncover new applications and market opportunities**  
Emily Blair, Business Development Manager  
MILLIKEN
- 11:30 - 11:50 Monitoring and controlling plastic pellet quality: applying a novel optical inspection and automated analysis system**  
Brian Birmingham, Business Development Engineer  
SIKORA
- 12:00 - 12:20 Exploring the latest developments in process technology for challenging compounding applications**  
Dana Pulvino, National Sales Manager  
BUSS USA
- 
- 12:30 - 1:15 TRAINING SEMINAR: Designing extensional mixing in extrusion**  
João Maia, Professor, Macromolecular Science & Engineering  
CASE WESTERN RESERVE UNIVERSITY
- 
- 2:00 - 2:20 Assessing the process-induced properties of graphene-polyethylene nanocomposites**  
Dr. Nima Moghimian, Product Development Manager  
NANOXPLORE
- 2:30 - 2:50 Sustainable polymer additives from recycled feedstocks: novel tools to drive performance and enhance value while contributing to the circular economy**  
Domenic DiMondo, Vice President Technology & Business Development  
GREENMANTRA TECHNOLOGIES
- 3:00 - 3:20 Studying the mixing performance of low-shear screw elements on high-speed compounding processes to improve output rates and polymer properties**  
Dr. Haikun Xu, Process Engineer  
KRAUSSMAFFEI CORPORATION
- 
- 3:30 - 4:15 TRAINING SEMINAR: Understanding and formulating plastic compounds**  
Chris DeArmitt, President  
PHANTOM PLASTICS

## THEATER 2 - DAY 2

- 9:30 - 10:15 TRAINING SEMINAR: Top tips for optimizing twin-screw extrusion**  
Bert Elliott, Engineering Manager  
LEISTRITZ EXTRUSION
- 
- 10:30 - 10:50 Lightweighting strategies with Talc in automotive TPOs**  
Piergiorgio Ercoli Malacari, Product and Application Development  
IMI FABI
- 11:00 - 11:20 Silicones as high-performance additives**  
Dr. Daniel Calimente, Technical Manager  
WACKER CHEMICAL CORPORATION
- 11:30 - 11:50 Examining flexible compounding technologies for the production of long-fiber thermoplastics (LFTs)**  
Sebastian Jost, Manager Design & Engineering  
FEDDEM
- 12:00 - 12:20 Improving the wear-resistance of plastics: Advances in PTFE micropowders and new developments in non-halogen additives**  
Dr. HyunSeog Kim, R&D Manager  
SHAMROCK TECHNOLOGIES
- 
- 12:30 - 1:15 TRAINING SEMINAR: How to evaluate and control the color of plastics**  
Frank Koger, Technical Sales Engineer  
KONICA MINOLTA SENSING AMERICAS
- 
- 2:30 - 2:50 Tailoring the electrical conductivity of thermoplastics using carbon black masterbatches**  
Jakub Olšan, Researcher  
UNIPETROL RPA - POLYMER INSTITUTE BRNO
- 3:00 - 3:20 Using an innovative chain extender to improve the performance of recycled polyester**  
Duan Hao, R&D Market Development Manager  
FINE-BLEND COMPATIBILIZER
- 
- 3:30 - 4:15 TRAINING SEMINAR: Understanding the basics of polymer degradation and stabilization**  
Ronald Becker, New Business Development Manager - Americas  
SI GROUP

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Speakers over the two days include representatives from:

Information correct at time of publishing. Speaker line up and titles subject to change.



## TYPES OF PRESENTATIONS

### Business Debates

Business debates will run for 45 minutes and feature influential industry leaders discussing strategic issues facing the global compounding industry. They will be focused on specific sectors of the compounding market including engineering plastics, masterbatch, PVC, and cable compounds.

### Training Seminars

A series of six practical training seminars will be delivered by experts on a range of topics, such as specifying and optimizing compounding lines, meeting regulatory requirements, and monitoring and controlling color.

### Industry Presentations

There will also be more than 30 presentations covering the latest technology developments and industry trends. Topics being covered include market analysis, process optimization, conductive compounds, material characterization, flame retardants, polymer stabilization, carbon fibers, computer simulation, compatibilizers, quality control, long-fiber thermoplastics, sustainability, wear-resistant plastics, and nanocomposites.

## LOCATION AND VENUE

The Compounding World Expo, will be held at the Huntington Convention Center in Cleveland, Ohio, USA. This state-of-the-art exhibition facility is located right in the heart of Cleveland's revitalized downtown boasting plentiful parking, free public transport and surrounded by an excellent selection of hotels.

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\*Tickets are available to registered attendees of the exhibitions only.





PHOTO: ENTEK

# Twin screws compounders evolve to changing needs

*High volume compounders and niche producers place differing demands on the twin screw extruder. Mark Holmes looks at how machinery manufacturers are meeting these requirements*

The twin screw extruder is central to the majority of compounding operations. These workhorse machines have long proved themselves able to handle a wide variety of polymers, additives and fillers. However, compounders are now seeking even higher levels of productivity, energy efficiency, production flexibility, reliability, ease of maintenance and shorter set-up times to maximise the return from their compounding plant.

When asked to assess the principal requirements for a twin screw extruder in 2019, Dean Elliott, Technical Processing Manager at **ENTEK**, highlights, among others, the need to be lean. "There is a general focus on lean manufacturing," he says. "Most customers are at some point on their lean manufacturing journey. As equipment suppliers, we

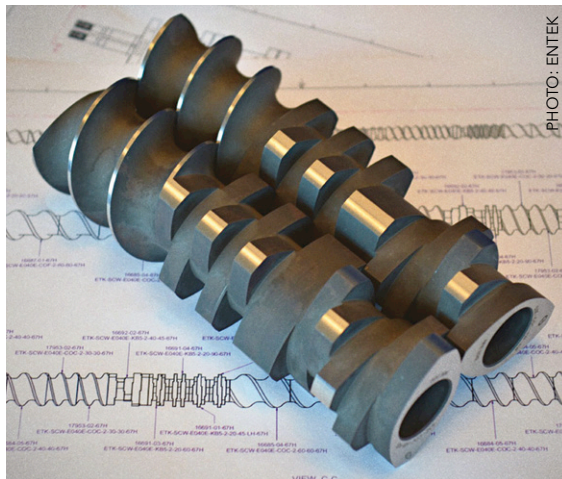
need to ensure that we are supporting this journey in the design and operation of our equipment."

Elliott says uptime is vital for most small to medium batch compounders. "These compounders need quick changeover and cleaning, as well as the ability to transition without contamination from batch to batch," he says. "There is significantly more operator hands-on activity around the extruder, which means safety interlocks and guarding have become more essential. Mistake-proofing the equipment as much as possible is also important, so tasks are completed correctly the first time."

Elliott says these were all key considerations in its development of the company's QC<sup>3</sup> line of extruders. "We included many features to address these customer needs, such as quick-turn fasteners

**Main image:**  
In addition to supplying productive equipment, twin screw machinery makers must be able to support customer trials with pilot plant, says ENTEK

**Right: Screw profiles and metallurgies must adapt to the latest material demands**



on guards for fast but safe access, point-of-use tools on the extruder, our patented quick-change couplings, screws that can only be installed the correct way on the shafts, and quick removal of feed chutes for easy cleaning, for example. We are seeing customers produce ever smaller batch sizes. This makes development and improvement of changeover features even more important to help minimise downtime. Our customers want their operators to be able to complete changeovers without involving the maintenance department, making mistake-proofing more important," he says.

For medium to large batch compounders, the requirement list is more focused on reliability and minimal maintenance. "These compounders need a responsive supplier with parts available to ship at short notice to keep the equipment running," says Elliott. "Technical specifications are also important - they want the greatest possible throughput for a given extruder size in terms of  $O_D/I_D$  diameter ratio and torque density. We are also seeing a world of changing raw materials that are becoming more difficult to process. Customers want technology that addresses these challenging materials. This can range from processing assistance for difficult materials to improved metallurgy for longer life screws and barrels."

**Right: The ZE BluePower series from KraussMaffei Berstorff is prepared for data acquisition and analysis**

**Challenging materials**

Elliott adds that there are also new markets and applications emerging that will require new developments in twin screw extrusion. "Bioplastics are getting a lot of attention currently as the sustainability issue in the plastics industry gains momentum and needs to be addressed," he says. "Many of these materials and additives present challenging processing issues."

ENTEK has provided both small and large twin-screw extruders for the bioplastics market over the years, including the supply of production-ready machinery for large lot production of bioplastic materials to Danimer Scientific in 2012. "This was a 103mm machine for high production of polyhydroxyalkanoates polyester," says Elliott. "Danimer's PHA, compounded on ENTEK machinery, was used in the product that won the prestigious 2018 Innovation in Bioplastics Award from the Washington DC-based Plastics Industry Association (PLASTICS). Danimer was a joint winner of the award along with PepsiCo for their development of the next generation bio-based and compostable flexible packaging used for a new Frito-Lay snack bag."

Aside from twin screw extrusion equipment developments, Elliott also sees a key part of the machinery maker's role in supporting customers in the development of new compounds or processes. "Overall, an OEM with technical processing expertise and a pilot plant for running trials is particularly advantageous so that the customer does not have to take production down on their own line," he says. "This has become especially important with the exponential demand on customers' existing equipment."

**Flexible production**

Alongside high productivity and energy efficiency, **KraussMaffei Berstorff** highlights a number of additional key areas where the company has focussed the development of its ZE Blue Power series of twin screw compounding extruders. "These include good production flexibility, reliability, maintenance friendliness and short set-up times," says Michael Roelfs, Product Management Compounding.

"In addition, another major current trend relates to the circular economy, where the recycling of plastics now plays a key function. With our Edelweiss compounding technology, we are focussing on the upcycling of plastics waste in this market to generate higher value plastics," he explains. "Finally,



# Fire Retardants in Plastics

Pittsburgh / 2019

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**Right: KM Berstorff's process data acquisition system helps to fully optimise system performance**

a further focus is on Industry 4.0 solutions for compounding extruders. This includes state-of-the-art data acquisition, where processing and analysis can significantly simplify the daily production routines of compounders and provide valuable in-depth information for process optimisation."

**Managing data**

KraussMaffei Berstorff now offers two data collection and processing solutions for twin-screw extruders in the ZE BluePower range. The first of these is designed to collect all production data synchronously from a compounding line. It comprises tuned hardware and software components for acquisition, recording, evaluation and processing of all process and measured values. The company says data analysis provides a sound basis for process optimisation, in particular when it comes to process modifications or planned quality improvements.

Due to a modular design and simple configuration, the company says the system can be adapted to a wide range of different applications, can be scaled in size and is suitable for interface-independent operation. All interfaces can be integrated into an overall system that collects and visualises process data such as pressure, temperature, speed and volume flow values of all upstream and downstream components - for example, metering systems, melt filters, melt pumps and pelletising systems - as well as the extruder parameters that are combined in a single system.

The second process monitoring development is designed to detect metering errors instantly in order to reduce production scrap and enhance line efficiency in colour applications. The in-line system projects light into the melt, from where it is reflected and then detected by a high-resolution glass fibre sensor. After comparison with a previously defined set-point, any deviation in terms of brightness or colour is instantly recognised and indicated. The colour measuring system can be integrated into the overall line control.

KraussMaffei Berstorff says the ZE BluePower twin-screw extruder series is characterised by high energy efficiency, good safety, simplicity in use and low maintenance requirements. According to the company, the 1.65  $O_D/I_D$  diameter ratio and specific torque of up to 16 Nm, means that both volume- and throughput-limit-



PHOTO: KRAUSSMAFFEI BERSTORFF

ed formulations can be compounded on the same machine. The company says the 4D and 6D barrel sections can also be combined with a wide range of modular screw elements to create bespoke configurations for special applications. Other highlights of ZE BluePower extruder design include oval liners, improved side feeders and degassing units, and an optional energy management tool.

**Optimising performance**

At its Extrusion Days event at its headquarters in Stuttgart in Germany late last year, **Coperion** General Manager Engineering Plastics and Special Applications Peter von Hoffmann said the focus of twin screw extrusion technology development is moving from the extruder to the system. "We are at a level now [with the high performance ZSK twin screw extruder] where we don't really need more torque and we don't have a call to go up in speed. It is more a process of optimisation of screws and feeding to improve efficiency."

Part of that drive to improved efficiency comes from speeding up changeover times. Coperion has completely overhauled its ZS-EG twin screw side devolatilisation unit for devolatilisation of extrusion processes with ZSK extruders as well as its ZS-B side feeder. The company says the new ZS-EG easy and the ZS-B easy models permit much faster dismantling from the ZSK process section and the twin screws can be changed more easily.

According to the company, connection to the ZSK barrel has been optimised for quick changes, allowing all four mounting bolts to be simultaneously undone in a circular movement. In addition, the screw shafts can be completely loosened, cleaned, or changed in only a

**Right: Coperion's Involute elements are one example of its output enhancing screw profiles**





# Polymer Sourcing & Distribution

Barcelona / 2019

*Paradigm shift in global polymer sourcing & distribution*

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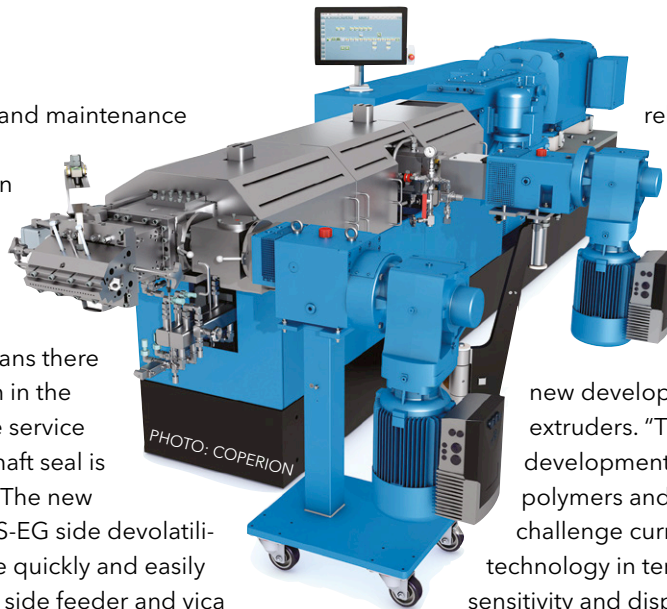
**Right: A ZSK twin screw extruder from Coperion fitted with the latest ZS-EG easy side devolatilisation unit**

few moves. Cleaning and maintenance times are significantly reduced as a result. An additional improvement to the new ZS-EG easy is the use of radial shaft sealing rings. This means there is no longer a vacuum in the gear lanterns, and the service life of the gear-side shaft seal is considerably greater. The new gearbox means the ZS-EG side devolatilisation unit can also be quickly and easily converted into a ZS-B side feeder and vice versa.

Coperion adds that side feeding can provide considerable performance benefits over top feeding. The company says the performance capability of extruders with a conventional top vent barrel can often be limited, particularly for extrusion of low viscosity melts and extrusion processes with high gas volumes. With its large free cross-section for devolatilisation, the ZS-EG twin screw side devolatilisation unit for the ZSK extruder keeps the melt in the process section without product leakage even at the maximum specific torque of the extruder. Throughput increases of up to 30% are said to be possible while simultaneously improving product quality.

**Efficient conversion**

Adam Dreiblatt, Director, Process Technology at **CPM Extrusion Group** highlights what he sees as the key attributes for a compounding extruder. These include efficiency in converting raw materials into value-added products that meets the needs of the customer, as well as ease of operation and user-friendliness for operations and maintenance staff. He says that extruders need to be



reliable and provide the flexibility to adapt to changing market demands, such as new formulations.

Dreiblatt identifies a number of influences driving new developments in twin screw extruders. "These include the development of new materials - polymers and additives - that challenge current and existing technology in terms of temperature sensitivity and dispersion requirements, for example," says Dreiblatt. "A good example is recent trends in nanocomposites, where despite much effort, processing on twin screw extruders can still not be achieved. In addition, there are new filler materials for thermal and electrical conductivity, such as boron nitride, graphene and carbon nanotubes, for example. Finally, the twin screw extruder market is highly competitive, so there is a need for differentiation."

According to Dreiblatt, other issues affecting developments in twin screw extrusion include closed-loop recycling of materials not typically in the post-consumer or post-industrial waste streams. In addition, the removal and disassembly of extruder screw elements from shafts remains a problem for all users of twin screw extruders, with current procedures requiring heating with torches and application of force using hammers. This process carries real safety issues but is part of routine maintenance for many.

**Feeder sensitivity**

High capacity twin screw extruders are also extremely sensitive to feeder variation within the residence time range of the extruder. At very high output, residence time in an extruder is less than 10 seconds - this requires feeders to deliver consistent and accurate metering of raw materials within this time frame. In the past at lower capacities, residence time in an extruder was 30 seconds to one minute - current feeder technology can meet this requirement but technology is challenged at a shorter time scales with high speed and torque twin screw extruders.

Dreiblatt adds that new screw element geometries are being developed to overcome temperature, pressure and shear peaks that exist with the Erdmenger profile - the original co-rotating twin screw extruder element

**Right: Reliability and flexibility are key demands for modern twin screw compounding equipment according to CPM Extrusion**



# Composites in Rail

Berlin / 2019

*The challenges and opportunities for composites in rolling stock  
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geometry. "Several different approaches are being deployed," he says. "The market will determine if any value is added, for example, the opportunity for better dispersion, lower melt temperature and higher capacity. Finally, 'smart' extruders are being developed that can monitor screw wear, predict maintenance requirements and optimise process conditions - all incorporated into an extruder control system. We are introducing new developments for twin screw extrusion at K 2019 later in the year," he says.

**Focused on flexibility**

With production and energy efficiency in mind, **Leistritz** showed its prototype fleXXcover at last year's Fakuma show. Manufactured in a coated engineering fabric, the company says that it offers better handling and greater flexibility, as well as easier equipment cleaning and lower cost, compared to metal alternatives. "We have taken a completely new approach in terms of machine cover," says Managing Director Anton Fürst.

The cover is made of a PTFE-coated glass fibre textile that provides the heat-resistance required for extrusion processes. The fleXXcover has a lower thermal conductivity than metal, which results in a lower surface temperature that improves operator safety. It is designed in four parts; two cover halves above the process section and two above the drive unit. They are attached to the base frame by means of plug-in connecting bars and fixed in place using pneumatic tensioning elements.

"This type of set-up allows very simple handling," says Fürst. "A single operator is able to remove each of the four parts without any additional tools. The removed cover can easily be rolled up, stored and exchanged. The combination of material, fixation and simple handling makes cleaning very convenient. Since this is a more economical option than metal covers, each of the four cover parts can be purchased more than once if required, for example if the process set-up is changed. Leistritz side feeders or degassing units integrated into the process set-up are also covered with the material."

The fleXXcover was demonstrated in a design study on a ZSE 40 iMAXX twin screw extruder - an extension of the ZSE iMAXX range that already includes machines with 27 and 35 mm screw diameters. With a high specific torque (up to 15.0 Nm/cm<sup>3</sup>), ZSE MAXX machines are

powerful co-rotating twin screw extruders offering high volume due to the  $O_D/I_D$  ratio of 1.66. The ZSE 40 iMAXX is particularly suitable for medium batch sizes and throughputs of up to 700 kg/h. It features a heating/cooling system fully integrated in the frame and an energy-efficient synchronous AC motor for the main drive.

The latest development from **STEER** is its next generation Omega Fractional Lobe Processor. The company says that the Omega co-rotating twin-screw extruder controls the amount of work done inside the extruder and residence time, significantly enhancing mixing and melting capabilities.

**Solid state mixing**

According to Atanu Maity, Chief Executive Officer, the Fractional Lobe Processor works on materials in the solid state to achieve intimate interaction between constituents while imparting physico-chemical changes through reaction, devolatilisation, shear, compression, elongation, surface renewal, distribution and dispersion - either alone with minimal interfering effects from other actions or in any desirable combination of actions. Work imparted by the Fractional Lobe provides high uniformity and is said to eliminate hot zones that could result in material degradation. The company says that Omega extruders with the special processor offer improved efficiency when handling difficult to process materials and in applications that need lower residence time and/or tightening of residence time distribution.

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

- > [www.entek.com](http://www.entek.com)
- > [www.kraussmaffeiberstorff.com](http://www.kraussmaffeiberstorff.com)
- > [www.coperion.com](http://www.coperion.com)
- > [www.centuryextrusion.com](http://www.centuryextrusion.com)
- > [www.leistritz.com](http://www.leistritz.com)
- > [www.steerworld.com](http://www.steerworld.com)

**Right: The unusual-looking fleXXcover from Leistritz is designed to improve safety, speed change-overs and reduce cost**



# Polymer Foam

Pittsburgh / 2019

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2019

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*AMI's 14<sup>th</sup> Polymer Sourcing & Distribution conference takes place in Barcelona in May. We take a look at the speaker line-up for this industry-leading event*

# Maintaining a lead in polymer distribution

Plastics distributors play a vital role in today's polymer industry. However, they are operating in a rapidly changing marketplace that is facing considerable uncertainty. Recent polymer capacity expansions in North America and Asia are putting pressure on producers in Europe and the Middle East, the EU's commitment to a circular economy is forcing re-evaluation of key strategic investments, and emerging signs of slowing in some of the world's major economies - combined with the potential re-emergence of trade wars and the as-yet-to-be-determined impact of Brexit - is creating concern throughout the supply chain.

Taking place in Barcelona in Spain on 13-15 May 2019, AMI's 14<sup>th</sup> Polymer Sourcing & Distribution conference will bring together polymer producers, distributors, traders, plastics processors and logistics companies to discuss how these uncertainties are impacting on the sourcing and distribution of polymers in Europe. Expert speakers will examine topics such as the changing structure of

the plastics processing industry, the potential effects of Brexit on EU plastics activity, and the role of e-commerce and emergence of new transactional technologies such as blockchain. This article previews the event.

The conference will open with an in-depth look at the latest trends in the European plastics distribution market. **Elena Mozzato**, Senior Research Analyst at **AMI** in the UK, will open proceedings with an analysis of the strategic inflection points that push traders to become official distributors. She will also discuss some key market data from AMI's latest Polymer Distribution in Europe report. **Eric Lundén**, General Manager at **Biesterfeld Nordic** in Denmark, follows with a case study of market expansion within the distribution industry. And **Wolf Koehler**, General Manager at **Ter Plastics Polymer Group** in Germany, explores the specialties of engineering polymer distribution.

Turning to the topic of digital disruption, **Riccardo Parrini**, CEO of **PlasticFinder** in Italy, will



Expert speakers at Polymer Sourcing and Distribution in Barcelona in May include (from left to right) AMI Senior Research Analyst Elena Mozzato, Biesterfeld Nordic General Manager Eric Lundén, Ter Plastics Polymer Group General Manager Wolf Koehler, Plastribution Managing Director Mike Boswell, ChemOrbis Chief Representative Ezio Filippi, and ChemCourier Deputy Chief Editor Ana Mastynets

investigate the role of the web in trading of plastics as a support for the circular economy. **Phillip M Karig**, Managing Director of **Mathelin Bay Associates** in the US, will talk about the opportunities offered to the distribution industry by blockchain technology. And **Fouad Saad**, Managing Director of **Resipol** in Oman, will focus on wider disruptive technologies and hurdles facing distributors.

The conference will then move on to current challenges and opportunities. An analysis of the European recycled polymer market will be delivered by **Elizabeth Carroll**, Research Analyst at **AMI Consulting** in the UK. **Guenther Eberhard**, Managing Director of **Districonsult** of Switzerland, will discuss how polymer distributors can thrive in today's ultra-competitive environment. **Mike Boswell**, Managing Director of **Plastribution** in the UK, will present his reality check on Brexit and detail the challenges for UK and EU plastic processing. **Geert Van De Ven**, Managing Director of the **Rotterdam Polymer Hub** in the Netherlands, will detail the current and future perspective for **logistics** and supply chain management. Then **Andrew Reynolds**, Director of **Advance Bidco** in

the UK, will close the first day with an analysis of the changing shape of the European plastics processing industry.

The main theme for the second day of Polymer Sourcing & Distribution 2019 will be geopolitics and the likely impact on Europe of global polymer investments. **Esteban Sagel**, Principal at **Chemical and Polymer Market Consultants** in the US, opens the debate with an assessment of the impact of the US/China trade war on the polymers market. **Mark Winkler**, Sales Manager and Team Leader Europe at **Sibur International** in Austria, will follow with an analysis of the new polyolefin capacities coming on stream in Russia.

**Ezio Filippi**, Chief Representative at **ChemOrbis** in Italy, will discuss the new polyethylene capacities under construction in the US. **Manuel Navarro Guerrero**, Sales Manager at **Repsol** in Spain, will address the theme of the circular economy and will examine how plastic can play the part of solution rather than problem. And the conference will be closed by **Ana Mastynets**, Deputy Chief Editor at **ChemCourier** in Russia, who will provide an insight into the PE, PP and PVC markets in Eastern Europe and highlight opportunities there for suppliers.

## Polymer Sourcing & Distribution 2019

The 14th Polymer Sourcing & Distribution conference takes place in Barcelona, Spain, on 13-15 May 2019, once again providing a forum for polymer producers, distributors, traders, plastics processors, logistic companies as well as brand owners, to explore the latest trends and strategic developments in the global polymer distribution industry. Topics on the agenda this year will include US and Asian polymer capacity expansions, circular economy initiatives, Brexit, trade wars, e-commerce innovations, and blockchain technologies.

In addition to the packed two-day programme of expert formal presentations, the Polymer Sourcing & Distribution conference also provides plenty of opportunity for focused discussion and networking during the informal refreshment and lunch breaks, the pre-conference cocktail reception and at the optional conference dinner.

To find out more about attending, exhibiting or sponsoring Polymer Sourcing & Distribution, visit the [conference website](#) or contact the Conference Team Manager Maud Holbrook. Tel: +44 (0)117 314 8111; Email: [maud.holbrook@ami.international](mailto:maud.holbrook@ami.international)





# Optimise your industry knowledge with AMI's recommended databases

## Compounders and Masterbatch Producers in Europe



Identify 700 manufacturing plants producing compounds and masterbatches in Europe. This unique insight into the industry provides full contact and production details for each site.

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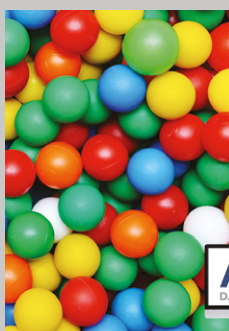
## Compounders and Concentrate Producers in North America



Find out about the latest developments in the compounding industry in the United States, Canada and Mexico. This directory gives key location and production details on all the players.

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## Compounders and Masterbatch Producers in South America



This database enables you to identify and interact with actual producers of compounds and masterbatches in Argentina, Brazil, Chile, Colombia, Ecuador, Peru, Uruguay and Venezuela.

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## Compounders and Masterbatch Producers in Middle East and Africa



Find reliable information on key producers of compounds and masterbatches in Algeria, Bahrain, Egypt, Ethiopia, Iran, Ivory Coast, Kuwait, Morocco, Nigeria, Oman, Saudi Arabia, South Africa, Tanzania, Tunisia, Turkey, United Arab Emirates.

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## Compounders and Masterbatch Producers in China



The Chinese plastics industry is developing fast, this database will give you the contact and production details of over 600 manufacturing sites in China producing compounds and/or masterbatches.

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## Compounders and Masterbatch Producers in India



Find out how the compounding industry in India is benefitting from the developments of all sectors of the plastics industry. Reliable data on over 200 companies producing compounds and masterbatches in India.

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The Compeo is the latest generation of kneader extruder from Buss and is designed to provide the utmost flexibility in application. This 12-page brochure details key features and model specifications.

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## COPERION: ZSK EXTRUDERS



Described as the benchmark for maximum throughput and product quality, the ZSK is Coperion's most flexible and highest performance twin screw extruder series. This 26-page brochure explains the design features and options.

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## CPM EXTRUSION: SYSTEMS AND PARTS



This new brochure from CPM Group details the extended range of compounding extruders, production lines and replacement parts available from the company following its recent acquisition of Germany-based Extricom.

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## LEISTRITZ: MASTERBATCH SYSTEMS



Additive and colour masterbatch production places specific demands on compounding equipment. This 16-page brochure from Leistriz explains how its ZSE 35 iMAXX masterbatch twin screw extruder rises to the challenge.

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## PROCOTEX: CARBON FIBRE



Procotex Corporation offers an extensive range of recycled carbon fibre reinforcements offering near-virgin performance at 30-50% of the cost. This brochure details the product options and fibre specifications.

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## BAY PLASTICS: STRAND PELLETISERS



Bay Plastics provides strand pelletisers and associated equipment to handle just about for any application. This four-page brochure details its full range of pelletisers, wet and dry-cut slides, water baths, air knives and dewatering units.

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If you would like your brochure to be included on this page, please contact Claire Bishop [claire.bishop@ami.international](mailto: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

## MASTERBATCH ASIA



The most established event for the Asian masterbatch industry, Masterbatch Asia returns to Bangkok in Thailand on 14-15 March for its 15th edition. Learn from and network with the industry's leading experts.

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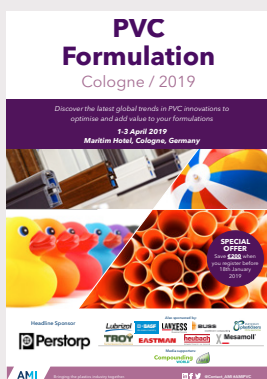
## POLYMERS FOR OIL AND GAS ENGINEERING



AMI holds its first Polymers for Oil and Gas Engineering conference on 27-28 March 2019 in Kuala Lumpur, Malaysia, where experts will examine specification, selection, performance and lifetime prediction of oil and gas polymers.

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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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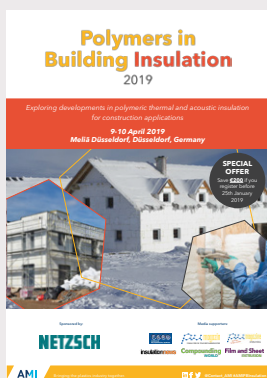
## FIRE RETARDANTS IN PLASTICS 2019



The ninth edition of AMI's Fire Retardants in Plastics conference will take place on 2-3 April 2019 in Pittsburgh, PA, USA, providing a meeting and learning point for all in the North American flame retardants industry.

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## POLYMERS IN BUILDING INSULATION



The second edition of AMI's Polymers in Building Insulation will take place on 9-10 April 2019 in Dusseldorf, Germany. The event will focus on the key trends, challenges and opportunities in construction insulation materials.

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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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# Learn more about AMI's upcoming conferences

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## POLYMER SOURCING & DISTRIBUTION



The 14th edition of AMI's Polymer Sourcing & Distribution conference will be held on 13-15 May 2019 in Barcelona, Spain. The event attracts attendees from across the plastics supply chain, from polymer producers and traders to processors and brand owners.

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## PERFORMANCE POLYPROPYLENE 2019



The second AMI Performance Polypropylene conference will be held in Cologne in Germany on 14-15 March 2019. The event will attract a global audience to discuss the latest developments in high performance PP compounds.

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## PLASTIC CLOSURE INNOVATIONS



Now in its seventh year, AMI's Plastic Closure Innovations conference takes place in Barcelona in Spain on 3-5 June 2019. This leading meeting point for the European industry focuses on innovation in both food and non-food closure applications.

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## OIL & GAS POLYMER ENGINEERING US



Taking place in Houston on 4-5 June 2019, AMI's fifth US conference for oil and gas operators, contractors, equipment manufacturers and researchers will provide detailed insight into the formulation, qualification and use of O&G polymer products.

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## COMPOUNDING WORLD CONGRESS



The fourth Compounding World Congress takes place on 4-5 June 2019 in Cologne, Germany. This high level event covers the market trends, business developments, and technical innovations impacting on producers of technical compounds.

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## POLYMER FOAM USA 2019



The seventh edition of AMI's Polymer Foam USA conference takes place on 18-19 June 2019 in Pittsburgh in the US. This international event examines the latest foaming technologies and applications in thermoplastics and elastomers.

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# China XD Plastic Company

<b>Head office location:</b>	Harbin, China
<b>Date founded:</b>	1985
<b>Chairman and CEO:</b>	Jie Han
<b>Ownership:</b>	Public Limited Company
<b>No. of employees:</b>	2,461
<b>Sales 2017:</b>	€1.1bn
<b>Production 2017(tonnes):</b>	710,000 (capacity, company data)
<b>Plant locations:</b>	Three plants in Harbin and one at Nanchong in China; one plant in Dubai in the UAE
<b>Profile:</b>	Founded in 1985 as Harbin Xinda Nylon Factory, China XD has grown to become one of the largest corporations within the chemical industry in China and listed on NASDAQ in 2009. It has seen considerable expansion over the past ten years and now claims 390,000 tonnes of capacity across its plants at Harbin and a further 300,000 tonnes at its plant at Nanchong, which opened in 2016 and was completed last year. It also has around 25,000 tonnes of capacity at its plant in Dubai, which opened in 2018.
<b>Product line:</b>	China XD produces compounds based on PP, ABS, PA6, PA66, POM and PPO amongst others. Its product range offers attributes such as high rigidity, toughness, flame retardance, scratch resistance, anti-static, heat resistance, chemical resistance and low warpage. It also offers low VOC emission and electroplatable grades. The main end use application sector is automotive.
<b>Company strengths:</b>	The company operates more than two hundred production lines with an overall capacity of 710,000 tonnes of production annually.

To be considered for 'Compounder of the Month' contact Elizabeth Carroll: [elizabeth.carroll@ami.international](mailto:elizabeth.carroll@ami.international)

## Compounding FORTHCOMING FEATURES WORLD

The next issues of Compounding World magazine will have special reports on the following subjects:

### April 2019

Thermally conductive compounds  
 Materials testing ● PPS compounds  
 Processing aids/lubricants  
 Preview: Compounding World Expo

### May

Wire and cable  
 Compatibilisers/coupling agents  
 Industry 4.0/plant management  
 High density compounds

Editorial submissions should be sent to Chris Smith: [chris.smith@ami.international](mailto:chris.smith@ami.international)

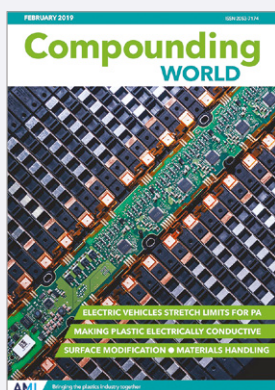
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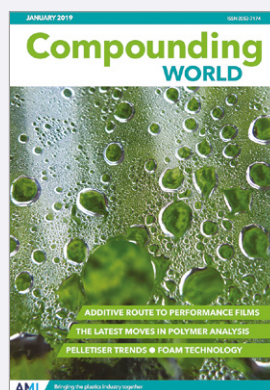
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## Compounding World February 2019

The February issue of Compounding World looks at the use of polyamide materials in the developing market for electric vehicles. The features also focus on Improving wear and reducing friction, electrically conductive compounds and materials handling solutions.

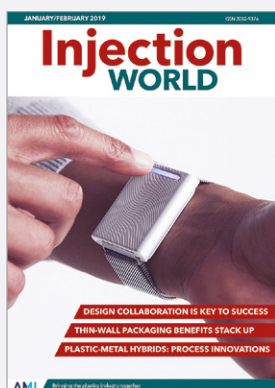
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## Compounding World January 2019

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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## Injection World January/February 2019

The January/February edition of Injection World magazine examines the role of designers and material producers in successful product developments. It also reviews innovations in polymer-metal hybrids and thin wall packaging.

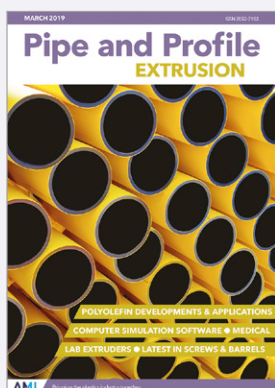
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## Plastics Recycling World January/February 2019

The January/February 2019 edition of Plastics Recycling World looks at barriers to recycling flexible packaging and how they can be overcome. Plus, this edition reviews IV enhancement options for PET and the latest pelletising developments.

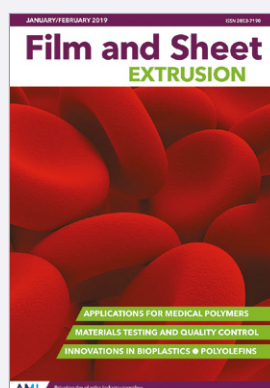
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## Pipe and Profile Extrusion March 2019

The March issue of Pipe and Profile Extrusion explores the growing use of PP in the pipe industry. It also takes a look at the latest developments in computer modelling, medical tubing technology, lab extruders and screw design.

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## Film and Sheet Extrusion January/February 2019

The January/February 2019 edition of Film and Sheet Extrusion magazine looks at some of the latest innovations in medical plastics. Plus an update on bioplastics and the latest innovations in polymer analysis and polyolefin resins.

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**GLOBAL EXHIBITION GUIDE**

2019	<b>10-12 March</b>	Asiamold, Guangzhou, China	<a href="http://www.asiamold-china.com">www.asiamold-china.com</a>
	<b>12-14 March</b>	JEC World, Paris, France	<a href="http://www.jeccomposites.com">www.jeccomposites.com</a>
	<b>12-15 March</b>	Pro-Pack Africa, Johannesburg, South Africa	<a href="http://www.propakafrica.co.za">www.propakafrica.co.za</a>
	<b>12-16 March</b>	Koplas, Goyang, Korea	<a href="http://www.koplas.com">www.koplas.com</a>
	<b>19-21 March</b>	EU Coatings Show, Nuremberg, Germany	<a href="http://www.european-coatings-show.com">www.european-coatings-show.com</a>
	<b>25-29 March</b>	Plástico Brasil, São Paulo, Brazil	<a href="http://www.plasticobrasil.com.br">www.plasticobrasil.com.br</a>
	<b>26-28 March</b>	PlastPrintPack Nigeria, Lagos	<a href="http://www.ppp-nigeria.com">www.ppp-nigeria.com</a>
	<b>28-30 March</b>	Mecspe, Parma, Italy	<a href="http://www.mecspe.com">www.mecspe.com</a>
	<b>2-5 April</b>	Plastimagen, Mexico City	<a href="http://www.plastimagen.com.mx">www.plastimagen.com.mx</a>
	<b>8-12 April</b>	Feiplastic, Sao Paulo, Brazil	<a href="http://www.feiplastic.com.br">www.feiplastic.com.br</a>
	<b>10-12 April</b>	Utech Las Americas, Mexico City	<a href="http://www.utechlasamericas.com">www.utechlasamericas.com</a>
	<b>8-9 May</b>	Compounding World Expo, Cleveland, US	<a href="http://www.compoundingworldexpo.com/na">www.compoundingworldexpo.com/na</a>
	<b>8-9 May</b>	Plastics Recycling World Expo, Cleveland, US	<a href="http://www.plasticsrecyclingworldexpo.com/na">www.plasticsrecyclingworldexpo.com/na</a>
	<b>8-9 May</b>	Plastics Extrusion World Expo	<a href="http://www.extrusion-expo.com/na">www.extrusion-expo.com/na</a>
	<b>8-9 May</b>	Plasttechnik Nordic Malmö, Sweden	<a href="http://www.easyfairs.com">www.easyfairs.com</a>
	<b>21-24 May</b>	Chinaplas 2019, Guangzhou, China	<a href="http://www.chinaplasonline.com">www.chinaplasonline.com</a>
	<b>21-24 May</b>	Moulding Expo, Stuttgart, Germany	<a href="http://www.moulding-expo.com">www.moulding-expo.com</a>
	<b>28-31 May</b>	Plastpol 2019, Kielce, Poland	<a href="http://www.targikielce.pl">www.targikielce.pl</a>
<b>11-12 June</b>	PDM Event, Telford, UK	<a href="http://www.pdmevent.com">www.pdmevent.com</a>	
<b>19-22 June</b>	Interplas Thailand, Bangkok	<a href="http://www.interplasthailand.com">www.interplasthailand.com</a>	
<b>5-7 September</b>	Utech Asia, Guangzhou, China	<a href="http://www.puchina.eu">www.puchina.eu</a>	
<b>16-23 October</b>	K 2019, Dusseldorf, Germany	<a href="http://www.k-online.com">www.k-online.com</a>	


**AMI CONFERENCES**

<b>14-15 March 2019</b>	Masterbatch Asia, Bangkok, Thailand
<b>27-28 March 2019</b>	Polymer for Oil & Gas Engineering, Kuala Lumpur
<b>1-3 April 2019</b>	PVC Formulation Europe, Cologne, Germany
<b>2-3 April 2019</b>	Fire Retardants in Plastics 2019, Pittsburgh, PA, USA
<b>13-15 May 2019</b>	Polymer Sourcing & Distribution, Barcelona, Spain
<b>14-15 May 2019</b>	Performance Polypropylene, Cologne, Germany

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