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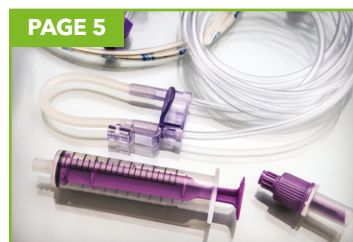
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CONTACT US

AMI

Third Floor, One Brunswick Square,
Bristol, BS2 8PE, United Kingdom
Tel: +44 (0)117 924 9442

Fax: +44 (0)117 311 1534

www.ami.international

www.twitter.com/plasticsworld

Registered in England No: 2140318

EDITORIAL

Editor-in-Chief: Chris Smith
chris.smith@ami.international

Technology editor: Peter Mapleston
editorial@compoundingworld.com

Contributing editor (USA): Jennifer Markarian
editorial@compoundingworld.com

Contributing editor (UK): Mark Holmes
editorial@compoundingworld.com

ADVERTISING

Advertisement manager: Claire Bishop
claire.bishop@ami.international +44 (0)1732 682948

Sales & commercial manager: Levent Tounjer
levent.tounjer@ami.international +44 (0)117 924 9442

Sales manager (China): Jenny Zhou
jenny.zhou@ami.international +86 13651 985526

Events and magazines director: Andy Beevers
andy.beevers@ami.international

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Baerlocher invests \$30m in India

Baerlocher is to invest \$30m at its production site at Dewas in Madhya Pradesh in India. The move will double PVC stabiliser production there by 2021 and expand capacity for metal stearates.

The Dewas plant, which Baerlocher acquired from National Peroxide in 1999, is already the largest PVC stabiliser production operation in India. The company said this latest investment confirms its commitment to the country's buoyant plastics industry and will enable customer conversion to calcium-based technology.

Baerlocher said the first phase of the project, which includes a new warehouse and an increase in its lead and calcium-based stabiliser production

capacity, is in the final phase of construction and will be commissioned by mid-2019. 10 hectares of land adjacent to the current plant has been acquired for the next phase of the project.

"With the demand for PVC in India growing annually by 7-8%, driven by growth in agricultural and infrastruc-



ture sectors, this investment shows our commitment to our customers and supports the country's 'Make in India' programme," said Jayen Modi, Managing Director of Baerlocher India.

"With our new capacity in 2019, we will remain as a reliable supplier of non-dusting lead stabilisers and liquid mixed metal stabilisers with room to grow further in these sectors. However, a range of exciting new product forms for calcium-based systems will be available to our customers for the first time in mid-2019," he said.

> www.baerlocher.com

Left: The Indian plant produces liquid and non-dusting metal stabilisers
Image: Baerlocher

Chem-Trend opens R&D laboratory

US-headquartered Chem-Trend has invested around €40m in an R&D laboratory at Maisach, near Munich in Germany.

The facility includes new equipment and dedicated laboratory space for Chem-Trend's thermoplastics, polyurethane and wood composite R&D teams. "The expanded lab space - especially the new test field for product development, evaluation, and demonstration - is key to delivering elevated service to customers, with a special focus on Europe-based OEMs," the company said.

The facility will also be used by sister companies Klüber and OKS.

> www.chemtrend.com

BASF starts China stabiliser unit

BASF Plastic Additives has officially opened the first phase of a world-scale antioxidants plant at its Caojing site on the Shanghai Chemical Industry Park in China.

With a capacity of 42,000 tonnes/year, the new facility will produce antioxidants

and related forms and blends for the plastic additives market. Powder blending, liquid antioxidant and shaping units are now fully operational.

Dr Markus Kamieth, a member of BASF's board of directors, said the move will "strengthen our position as

the leading global supplier of antioxidants". He said that China, which is the world's largest antioxidant market and accounts for around 65% of Asian demand, is expected to "show attractive growth rates in the medium to long term."

> www.plasticadditives.basf.com

Americhem investing in medical

Americhem is to build a dedicated white room compounding space at its site at Morrisville in Pennsylvania in the US, which focuses on medical compounds.

Construction is expected to begin in the summer. The investment will also house a design centre, where the company's technical experts will be able to work with customers to speed up their development processes.

"This expansion solidifies our commitment to the development and manufacturing of medical compounds," said Americhem CEO Matthew Hellstern.

> www.americhem.com

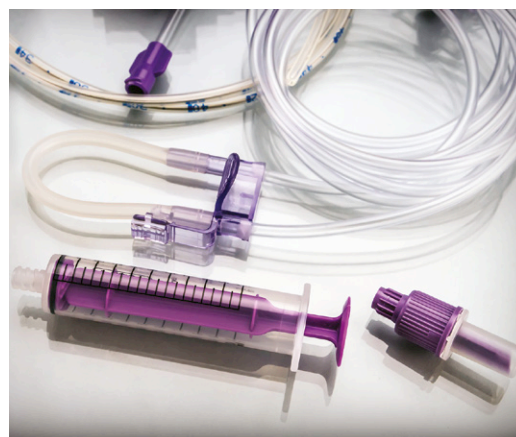


PHOTO: AMERICHEM

Medical investment includes compounding and development capabilities

Clariant adds medical approval worldwide

Clariant's three Mevopur medical compound production sites – at Lewiston in Maine in the US, Malmo in Sweden, and in Singapore – have been certified to ISO 13485-2016, the new quality standard for makers of plastic medical devices.

ISO 13485-2016 comes into full effect at the end of February this year after a three-year transition from the previous regime, the company said. From that date submissions under the old version will no longer be accepted. The standard only applies to medical device producers, but Clariant said it has implemented it to reduce risk to customers arising from changes in raw materials impacting device performance, reliability or



Clariant's Mevopur medical compounding plant in the US

compliance.

The company's Lewiston site has recently been expanded, adding extrusion equipment, materials handling, weighing stations, a maintenance area and additional water-cooling systems. Capacity has been

increased by 40% and the facility can now produce larger batch sizes and more rapid deliveries. In addition, a smaller line has been configured for processing fluoropolymer resins such as FEP, ETFE and PVDF.

> www.clariant.com

PHOTO: CLARIANT

Erema takes stake in Plasmac

Austria's Erema Group has bought a 60% stake in recycling machinery manufacturer Plasmac. Syncro Group, an Italian maker of blown film equipment that acquired the formerly UK-based company and relocated it to Busto Arsizio in Italy last year, will continue to own the remaining 40%. Syncro and Plasmac CEO Gabriele Caccia will remain at the helm.

Manfred Hackl, CEO of Erema Group, said Plasmac's Alpha direct feed extruder, its Omega shredder-extruder system

for throughputs of up to 250 kg/hour, and Powerfeed edge trim transport system will "expand our product range of systems for

straightforward standard applications in the in-house segment, which is very important to us".

Erema has already strengthened its position in this area with the introduction of its Intarema system and establishment of its Pure Loop subsidiary, which specialises in shredder-extruder technology for recycling of clean production.

Caccia said Syncro's blown film expertise will also bring valuable synergies to Plasmac.

> www.erima.com

> www.plasmac.co.uk



PHOTO: EREMA

Expanding in standard systems: Erema CEO Manfred Hackl

NEWS IN BRIEF...

German chemical consultancy **ChemService** has established a UK operation to provide Only Representative services to UK and EU27 companies needing to ensure compliance with EU-Reach and UK-Reach regulations in the event of a no-deal **Brexit**. More details on how chemical companies will be affected by the UK's departure from the EU can be found [HERE](#) and [HERE](#). www.chemservice-group.com

Germany's **KraussMaffei Berstorff** has announced Dieter Thewes as its new Chief Operating Officer, taking on responsibility for both the Hanover and Munich sites. Thewes brings more than 20 years of experience in the extrusion and packaging industries, most recently as Managing Director of IMA Dairy & Food Hassia Verpackungsmaschinen. www.kraussmaffeiberstorff.com

Foster Corporation is to distribute **Solvay's** KetaSpire PEEK and AvaSpire PAEK polyketone-based polymers in the North American medical market. The deal covers unmodified polymers and standard coloured grades currently offered by Solvay, as well as custom compounds produced by Foster for specific applications. The company already distributes Solvay's Radel PPSU, Udel PSU and Ixef polyarylamides. www.fostercomp.com

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More than 200 exhibitors join plastics shows in Cleveland

More than 200 companies have already booked booths at three new North American exhibitions focused on compounding, plastics extrusion and recycling. Organised by *Compounding World* publisher AMI, the *Compounding World*, *Plastics Extrusion World* and *Plastics Recycling World* Expos will take place at the Huntington Convention Center in

downtown Cleveland, OH, in the US on 8-9 May 2019.

The free-to-attend tradeshows and their associated free conferences will feature a wide range of processing machinery, auxiliary equipment, polymer materials, additives and related services.

"Visitors to the focused shows will be able to compare a huge range of suppliers and new technologies in one convenient location," said Andy Beevers, AMI's Events Director. "In addition, they'll be able to learn from expert speakers in the five free



Cleveland's Huntington Convention Centre hosts the new shows

conference theatres and network at the after-party at Cleveland's Rock and Roll Hall of Fame," he added.

The 200+ companies that have already booked booths include: Alpha Marathon, Addex, Advanced Blending Solutions, BASF, Brabender, Buhler, Buss, BYK, Cabot, Chemours, Clariant, Cloeren, Colines, Coperion, Cumberland, Davis-Standard, Dover Chemicals, Dr Collin, Entek, Erema, Exxel Polymers, Farrel Pomini, Ferro, Gneuss, Greiner Extrusion, Heritage Plastics, JSW, Konica Minolta, KraussMaffei Berstorf, Kuhne, Leistritz, Lubrizol, Maag,

Maguire, Matsui, Milliken, NFM, Nordson, Oden Technologies, Omya, Pall, Parkinson Technologies, PSI-Polymer Systems, Reifenhauer, SI Group, Starlinger, Struktol, Vecoplan, Wacker, Zoltek, and over 150 more suppliers from around the world.

The limited number of remaining booths are being filled on a daily basis. Prices start at \$3,400 for a 100 sqft

booth. To find out more about exhibiting at any of the expos, visit ami.ltd/USExpos_Exhibit.

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

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

SABIC alliance moves on circular polymers

SABIC announced that it is joining with three customers - consumer goods giant Unilever, wine closure maker Vinventions and packaging group Walki - to introduce International Sustainability and Carbon Certification (ISCC)-certified circular polymers this year.

The materials will be made using Tacoil, a feedstock from UK-based Plastic Energy derived from recycling of mixed plastic waste, and processed at SABIC's site at Geleen in the Netherlands. The move is part of SABIC and Plastic Energy's recently announced plan to build the first commercial plants to manufacture and process the feedstock.

"As a disruptive innovation, the introduction of the certified circular polymers in 2019 will create a new value chain, where SABIC, its upstream supplier and key downstream customers work side-by-side to upcycle mixed plastic waste," the company said.

> www.sabic.com



The ISCC polymers will be produced at SABIC's Geleen facility in the Netherlands

PHOTO: SABIC

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Production volumes up by 4.5% at R&P Polyplastic

Russian compounder R&P Polyplastic said it sold more than 80,000 tonnes of polymer compounds during 2018, up by 4.5% on the previous year.

Managing Partner Andrey Menshov said the growth had been achieved in the face of some key challenges. "Depreciation of the national currency led to an increase in prices of foreign raw materials. Another issue is the advanced growth of prices of basic polymers including polypropylene," he said.

The company said it had made "significant progress" in its strategic plan to expand its export activity, citing a number of shipments to customers in the Baltic States and Western Europe. It also said it had commenced bulk deliveries to some local customers at the end of last year, allowing them to benefit from logistics savings.

R&P Polyplastic supplies mostly PE, PP and PA compounds to customers in the automotive, appliance and construction



PHOTO: COPERION
Coperion compounding lines at R&P Polyplastic

industries (36%, 24% and 17% of its total production respectively). Batch sizes range from 5 to 60 tonnes.

The company operates six Coperion compounding lines – a combination of STS and ZSK models – at its production sites at Engels and Togliatti and three ZSK lines at its R&D centre in Moscow.

> www.polyplastic-compounds.ru/eng

Ampacet adds capacity in Europe

Ampacet has announced the start-up of two new colour production lines at its site in Dudelange, Luxembourg. It has also expanded the R&D and colour labs at the site, adding new injection and blow moulding machines to speed up its colour matching services.

The new capacity will reduce lead times and increase flexibility for delivery of polyolefin-based colour masterbatches, the company said. One of the lines will be dedicated to production of engineering polymers.

"Our focus is to provide high quality services and innovative solutions to our customers while reducing our impact on the environment. The new lines are designed to support this goal," said Marcello Bergamo, Managing Director Ampacet Europe.

> www.ampacet.com

Readco launches lab scale mixer

US-based Readco Kurimoto has introduced the RK-1 continuous mixing processor, a table-top laboratory-scale version of its proprietary mixing design capable of throughputs of 4.5 kg/h.

The RK-1 features twin shaft, co-rotating 25mm diameter screws set in a closed barrel and is said to be suitable for mixing, blending, reacting, crystallization, and/or encapsula-

tion applications. It combines heat transfer, mixing and shear to process multiple powdered, liquid and viscous ingredients in a single step.

> www.readco.com

Evonik expands PMMA compounding

Evonik has started up an additional line for compounding its Acrylite brand of PMMA moulding compounds at its site in Osceola, Arkansas, US.

The expansion, originally announced in January last year, near doubles the site's capacity for the Acrylite compounds. The company said it has been made to meet growing demand for speciality acrylic-based compounds.

Evonik claims that its Cyro Methacrylates business line is the only manufacturer with fully integrated MMA-PMMA production networks including downstream compounding in the Americas, Europe and Asia.

> www.evonik.com



PHOTO: EVONIK
Evonik officials cut the ribbon at the Osceola plant

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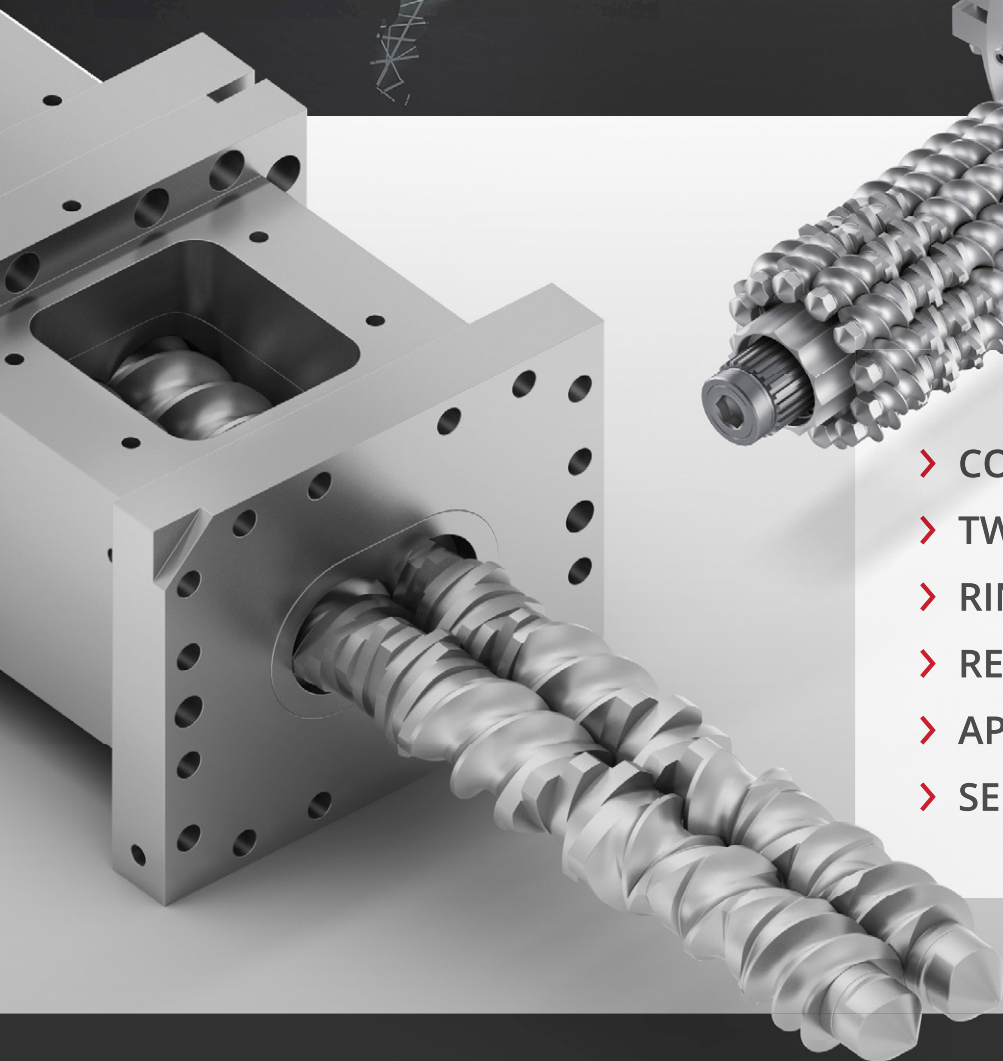
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Compounding World Expo to host free training seminars

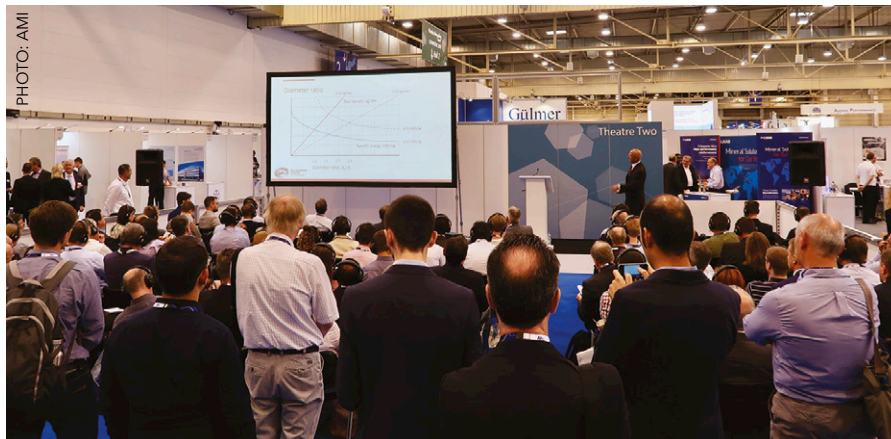
Visitors to the Compounding World Expo will be able to attend a series of six free training seminars covering a range of plastics compounding topics. The practical seminars will take place over both days of the exhibition, which is being held at the Huntington Convention Center in downtown Cleveland, OH, in the US on 8-9 May 2019.

Topics being covered in the training seminars include process optimisation, compound formulation, regulatory compliance, polymer stabilisation, machine specification, and colour measurement and control.

"The practical seminars will be delivered by acknowledged experts and experienced trainers," said Andy Beevers, Events Director at AMI, organiser of the exhibition and publisher of *Compounding World*. "We want to provide visitors with valuable educational content, in addition to the opportunity to meet more than 140 suppliers who will be exhibiting at the Compounding World Expo."

The opening training seminar will cover specification of twin-screw extruders for compounding. It will be given by Adam Dreiblat, Director of Process Technology at CPM Extrusion Group. Dreiblat has more than 35 years of twin-screw extrusion experience. Prior to joining CPM in 2007 he ran a consulting and training company focused on compounding technology. He also developed training workshops for the Society of Plastics Engineers.

The second training seminar will focus on regulatory compliance. Bernie Henn, Supplier Development Manager at Verisk 3E, will speak about modernising product stewardship for compounded, extruded or recycled



The training seminars attracted large audiences at the first Compounding World Expo in Essen, Germany, and expected to be equally popular in Cleveland

plastics. Verisk 3E provides compliance solutions to more than 5,000 companies around the world, including many leading chemical companies.

The next free training seminar will focus on understanding and formulating plastics compounds and will be delivered by Chris DeArmitt, President of Phantom Plastics. His extensive plastics industry background includes technical and management positions at BASF, Electrolux, and several suppliers of fillers and additives. DeArmitt has also written a book on innovation and works as a consultant on breakthrough materials, problem solving and training.

The first free training seminar on the second day of the Compounding World Expo will focus on optimising twin-screw extrusion and will be given by Bert Elliott, Engineering Manager at Leistritz Extrusion. He has extensive experience of commissioning and optimising compounding lines for a variety of applications. Elliott also wrote a series of articles on this topic for *Compounding World* magazine and has delivered talks on the subject at

the Compounding World Forum and other events.

The vitally important topic of evaluating and controlling colour in plastics will be covered in a seminar by Frank Koger, Technical Sales Engineer at Konica Minolta Sensing Americas. He will share key knowledge garnered during 30 years of work in the world of colour.

The final training seminar will be on understanding the basics of polymer degradation and stabilisation. It will be delivered by Ronald Becker, Business Development Manager at SI Group, who speaks regularly on this fundamentally important topic for compounders.

If you wish to attend any of the training seminars at the Compounding World Expo, register for your free ticket [here](http://www.compoundingworldexpo.com/na/). This will give you free admission to the exhibition and the two conference theatres, featuring technical presentations and business debates in addition to educational seminars. It will also ensure free entry to the Plastics Recycling World Expo and the Plastics Extrusion World Expo.

For more information on the Compounding World Expo, including the exhibitor list, stand booking details, conference programmes and online registration for your free ticket, please visit www.compoundingworldexpo.com/na/

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ECHA proposes microplastics ban

The European Chemicals Agency (ECHA) has published a proposal to restrict intentional addition of microplastic particles to products. This proposal could, if adopted, reduce the amount of microplastics released to the environment in the EU by about 400,000 tonnes over 20 years, the agency said.

Microplastics are defined as synthetic polymers less than 5mm in size that resist biodegradation. The proposed restriction targets microplastics in products from which they will inevitably be released to the environment. It covers multiple sectors and a

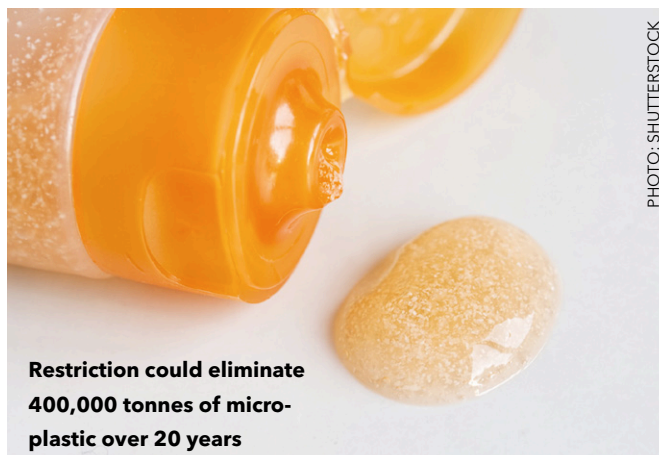


PHOTO: SHUTTERSTOCK

Restriction could eliminate 400,000 tonnes of microplastic over 20 years

broad range of applications, including cosmetics, detergents and maintenance products, paints and coatings, construction materials and medicines.

The decision follows an assessment by ECHA that

found that intentionally-added microplastics are most likely to accumulate in terrestrial rather than marine environments, as they concentrate in sewage sludge that is frequently used as a fertiliser. The

proportion released directly to the aquatic environment, despite recent publicity about their effects on the oceans, is much smaller.

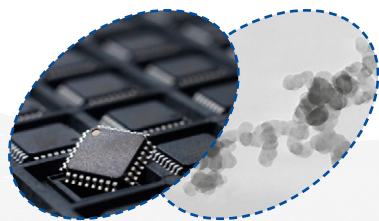
While the long-term health and environmental effects of microplastic are not yet fully understood, their persistence and the potential for adverse effects or bioaccumulation is causing widespread concern, ECHA said.

Several EU member states have already introduced partial microplastic restrictions, but these initiatives are mainly in wash-off cosmetic products, according to ECHA.

➤ <http://echa.europa.eu>

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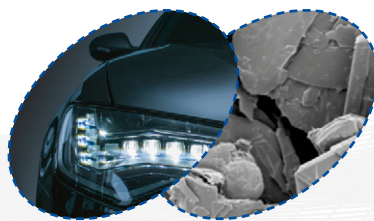
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Fighting friction and wear

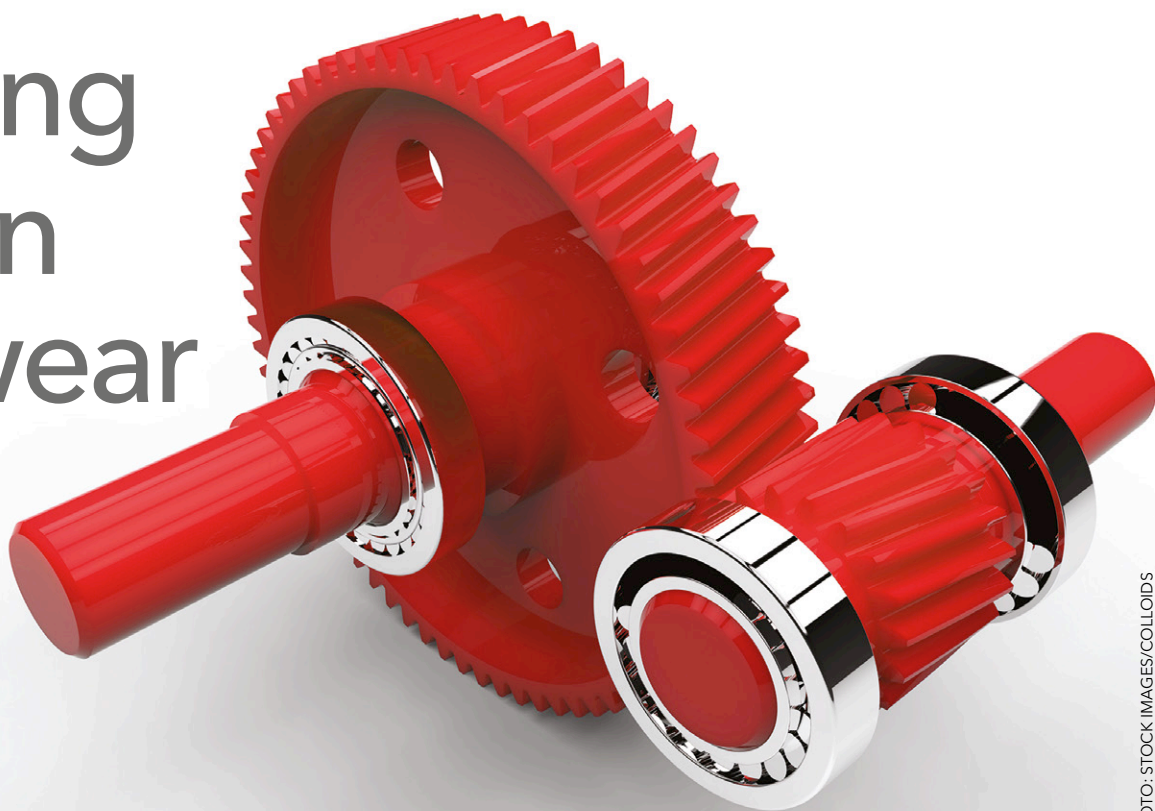


PHOTO: STOCK IMAGES/COLLOIDS

With plastics being used in increasingly demanding mechanical applications, the pressure is on to improve wear and reduce friction. Peter Mapleston reviews the latest developments

As plastics find increasing use in technical applications that call on high resistance to friction and wear, additive and compound companies are coming up with new, better and more sustainable ways to create compounds that are fit for purpose. Several of them were discussed at the first Wear-Resistant Plastics conference, organised last year by *Compounding World* publisher AMI. This article takes a look at some of the most recent developments.

Fluoropolymers, especially PTFE micropowders, are frequently used to reduce friction between contacting surfaces. When used in engineering plastics, PTFE can eliminate the need for external lubrication, reduce wear rates, achieve lower and more consistent frictional responses, and eliminate 'stick-slip' issues, chatter and other motion-induced noise. But PTFE is not a perfect solution and several companies are working on alternatives.

"Whereas PTFE lubricants - typically added to the thermoplastic material in the range of 10-20wt% - improve wear and friction performance, a fine balance is needed to maintain mechanical properties or processability of the base polymer,"

says Claus-Peter Keller, New Business Development Manager with **AGC Chemicals Europe**.

AGC Chemicals is a leading manufacturer of modified fluoropolymers, offering a range of anhydride-functionalised grades under the brand name of Fluon+. Well-established applications include double and triple-layer fuel lines, where an inner liner made of ETFE (ethylene tetrafluoroethylene) is coextruded with an outer liner of PA12. During processing, the anhydride groups react with end groups in the PA12 to provide the necessary adhesion.

Keller says AGC Chemicals recently investigated the use of anhydride-functionalised fluoropolymers as compounding additives in PTFE-filled thermoplastics. "First results show that an anhydride modified PFA (perfluoroalkoxy alkane) can improve the blending of PTFE into thermoplastics due to its higher surface energy in combination with its good compatibility with PTFE," he says. Tested with a PPS blend, there was seen to be a significant improvement in wear and friction performance. Adding 1phr of an anhydride-functionalised Fluon+ PFA EA2000 into an 80:20

Main image:
Plastic compounds for production of gears such as these need particularly good tribological properties and resistance to wear

PPS:PTFE blend cuts the dynamic coefficient of friction in half and improves the wear resistance by a factor of three (Figure 1).

Keller says that PTFE tends to agglomerate during the injection moulding process, but that adding a small amount of Fluon+ PFA EA 2000 can help reduce this effect. The result is better PTFE dispersion and hence better tribological performance. "This should also allow compounders to maintain the tribological performance at a given level with a reduced amount of PTFE lubricant with the benefit of better mechanical properties of the compound and better processability," Keller says.

A second option is the replacement of the PTFE lubricant with an anhydride-modified fluoropolymer, Keller says. Various polymers have been tested by AGC Chemicals. Table 1 shows the results of a pure PA6 vs PA6 blended with 5, 10 and 20% of an anhydride modified ETFE. "The advantage is the improved wear resistance and impact strength with a moderate compromise on mechanical properties only," he says. A top layer made of an anhydride-modified fluoropolymer film can also be used to achieve improved tribological performance at the surface of coextrusions or laminates, he adds.

The UHMWPE alternative

Shamrock Technologies claims leadership in production of PTFE micropowders. It offers a wide range of products made from natural prime as well as recycled PTFE and produces an extensive variety of particle sizes, molecular weights, and thermal stability. With the ongoing trend to find non-halogenated solutions for all sorts of applications - flame retardance and pigmentation being in the vanguard - Shamrock has now developed a halogen-free anti-wear additive for engineering plastics by proprietary processing of ultra-high molecular weight polyethylene (UHMWPE) powder with an average particle size of between around 30 and 50 microns.

Dr Hyunseog Kim, the company's R&D manager, discussed the development at the AMI conference, explaining that the newly developed additives in the Shamrock Technologies' UMFI series are available in standard and modified versions (UMFI 30N and 30X respectively). In tests on wear and coefficient of friction (CoF) reduction performance in engineering plastics, two different polymers - polycarbonate (PC) and polybutylene terephthalate (PBT) - were compounded with both additives. Samples were tested on a Block on Ring (ASTM

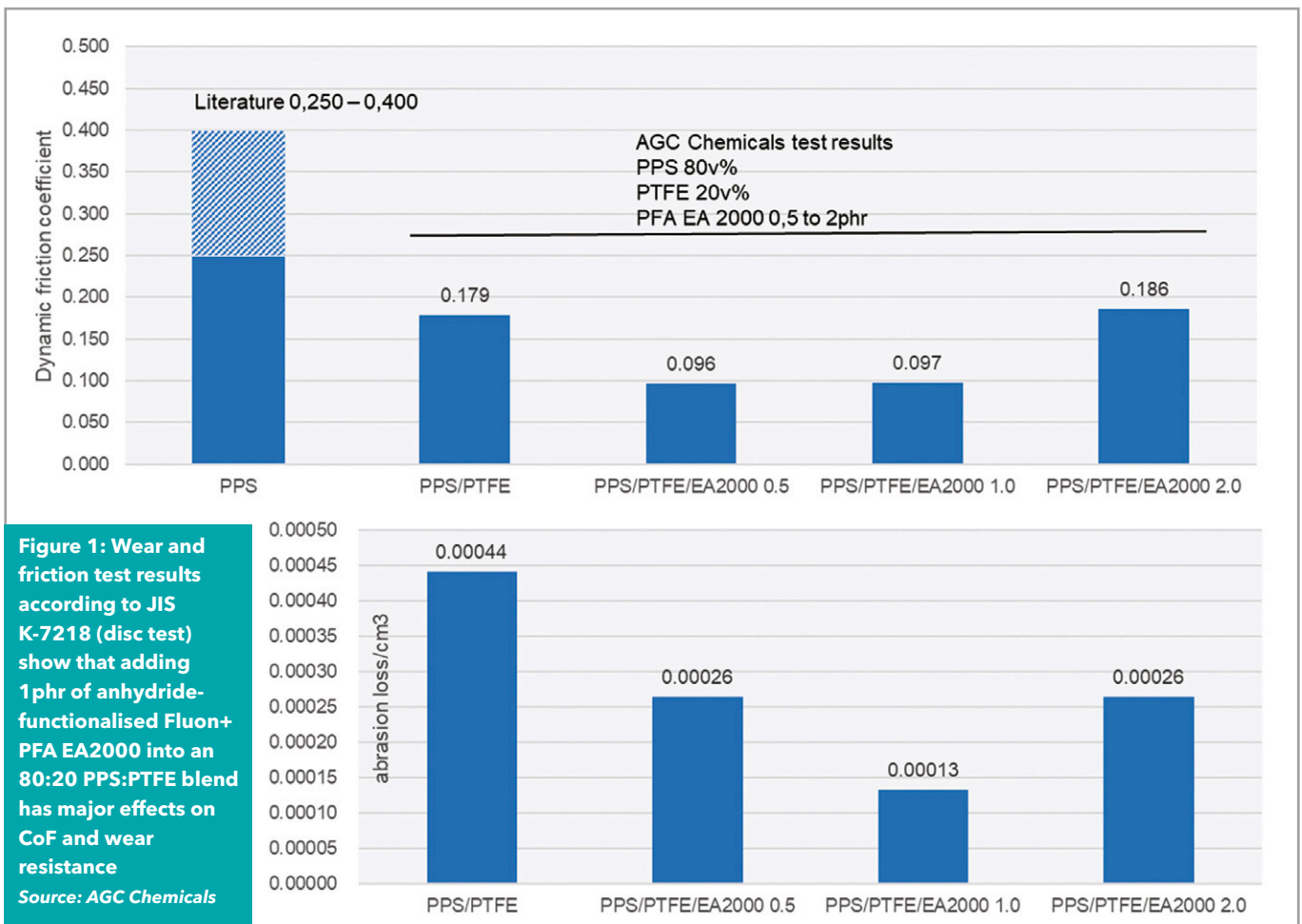
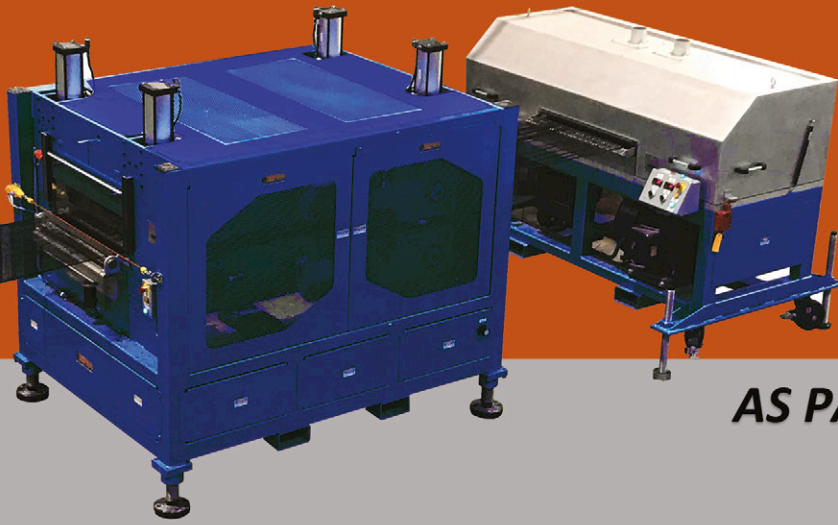


Figure 1: Wear and friction test results according to JIS K-7218 (disc test) show that adding 1phr of anhydride-functionalised Fluon+ PFA EA2000 into an 80:20 PPS:PTFE blend has major effects on CoF and wear resistance
 Source: AGC Chemicals

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%	Impact Strength (23°C) (J/m)	Impact Strength (-40°C) (J/m)	Flexural Modulus (Gpa)	Flexural Strength (MPa)	Tensile Strength (MPa)	Tensile Elongation (%)	Wear Resistance (cm ³)	Dynamic Friction Coefficient	Water Absorption (Weight%)
0	45	27	2.7	104	86	333	5x10 ⁻³	0.56	3.9
5	61	27	2.6	105	78	301	1x10 ⁻³	0.59	3.5
10	94	49	2.5	101	78	308	1x10 ⁻³	0.57	3.2
20	144	66	2.2	89	79	345	1x10 ⁻³	0.59	2.8

Table 1: Effect on mechanical properties of blending PA6 with varying amounts of anhydride-modified ETFE (tests carried out according to JIS)
 Source: AGC Chemicals

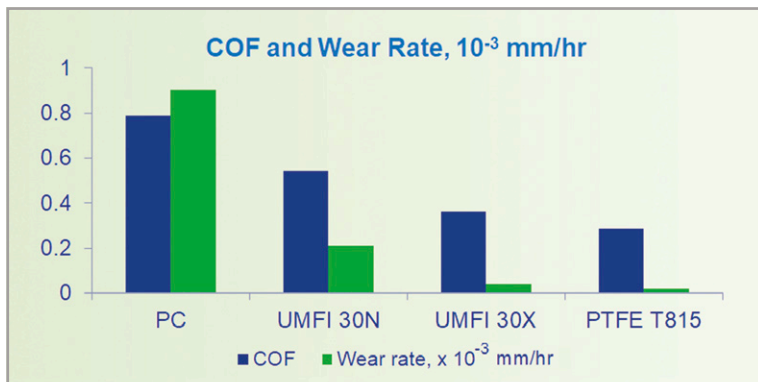


Figure 2: UMFI 30N and 5% UMFI 30X significantly reduce wear rate of polycarbonate, without lowering the CoF, compared with a compound containing 10% PTFE
 Source: Shamrock Technologies

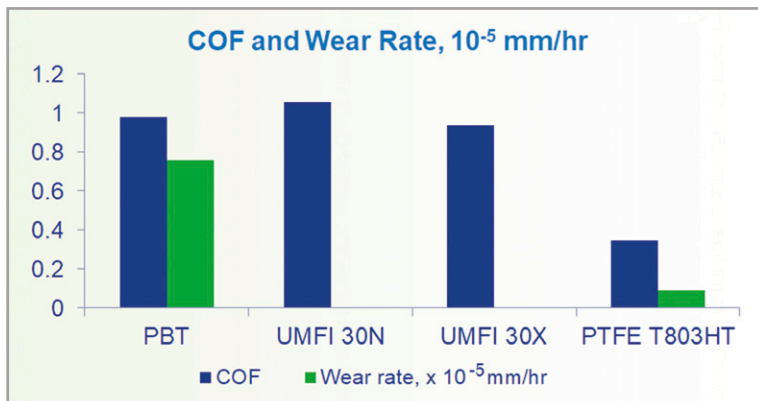


Figure 3: 5% UMFI 30N or 5% UMFI 30X reduce the wear rate to around zero in PBT and may even produce a negative value due to thermal expansion in the UHMWPE. CoF is not reduced compared with a compound containing 10% PTFE
 Source: Shamrock Technologies

G176 type) tribometer.

Kim says 5% UMFI 30N or 5% UMFI 30X additive in a PC compound significantly reduces the wear rate without lowering the CoF when compared with a PC compound containing 10% PTFE (Figure 2). In PBT compounds, 5% UMFI 30N or 5% UMFI 30X reduces the wear rate to around zero and may even produce a negative value due to thermal expansion in the UHMWPE, again without lowering the CoF

compared with a compound containing 10% PTFE (Figure 3).

“Based on our tests, UMFI 30N and UMFI 30X show good performance in engineering plastics as a wear and CoF control additive,” says Kim. “While it is not as proficient as Shamrock MicroFlon PTFE additive, UMFI will meet non-halogen requirements.”

Metal sulphide options

Austrian speciality metal sulphides producer **Tribotecc** has been carrying out a study into how new synthetic types affect tribological properties in high-performance plastics. “The tribological properties of metal sulphides [in] brake components are well established,” researchers say in a recent paper. “Engineered thermoplastic materials like PEEK, PPS and PPA can also benefit from this class of solid lubricants as their tribological properties are improved.”

The researchers compared the lubricating characteristics of two of the company’s binary sulphides (Tribotecc MOS XF and MOS WS 2) with a newly-developed multiphase synthetic metal sulphide (Tribotecc - SLS 22). They used Pin-on-Disc and Ball-on-Plate test equipment and also assessed basic friction behaviour using a Tabor friction tester. Failure analysis of the surfaces was carried out using visible light and scanning electron microscopy to correlate the friction and wear performance.

The tests showed that addition of 10% Tribotecc - SLS 22 in PEEK kept CoF on a constant low level while wear rate was significantly improved compared to the base polymer. Significant improvements in wear rate and a slight reduction of CoF were seen in a PPA compound containing 15% glass fibres with 10% solid lubricants (Figure 4). Friction test results (CoF and weight reduction) from a PPS compound with 30% glass fibres with different solid lubricants showed that by adding 10% of Tribotecc - WS 2 and 10% Tribotecc - WS 31, wear was significantly improved.

“There is a big potential for improving compounds for tribological applications by using new synthetic metal sulphides as solid lubricants,” the Tribotecc team concluded.

Anti-wear formulations

UK-based masterbatch specialist **Colloids**, part of Tosaf, is also making progress with metal sulphides for tribological applications – specifically molybdenum disulphide (MoS₂) – as well as with carbon-based additives. It recently added two low-friction and wear-reducing grades to its Pace

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Jim Drew, Plant Manager, OptiColor, Inc.



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

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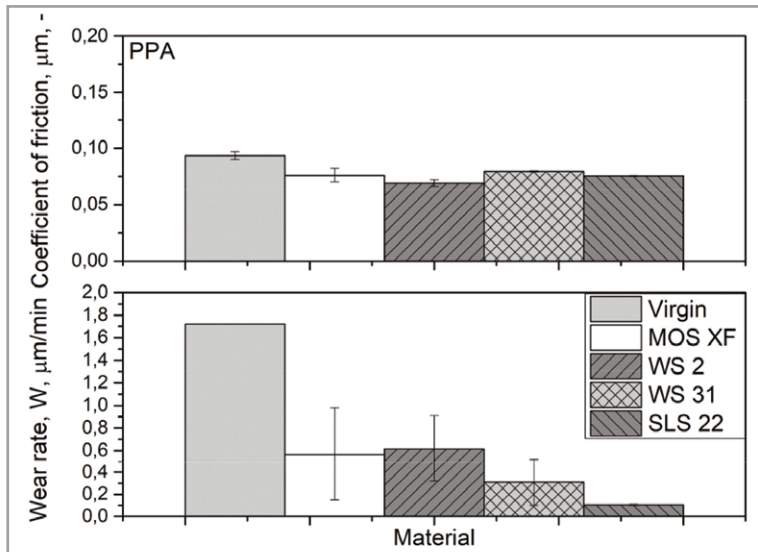


Figure 4: CoF and wear rate of PPA compounds containing different metal sulphides

Source: Tribotec

range of products for engineering polymers, primarily polyamides. Moulded or machined finished components containing the masterbatches can operate at ambient or elevated temperatures without the need for an external lubricant.

Pace MPA9D2338 anti-wear masterbatch incorporates MoS₂ in polyamide 6. Addition can be at the intermediate compounding step – for compounds used to extrude polyamide stock shape rods, plates, tubes and profiles, for example – or by direct addition in a final process such as injection moulding. End use engineering applications include: bearings, sheaves, gears, sprockets, rollers and wear components.

Pace MPA9D2339 incorporates fine graphite

particles in a proprietary PA resin blend. Graphite significantly reduces the coefficient of friction of a material, with some potential to also reduce abrasive wear. Examples of applications for low friction compounds include rotors and bearing components for water flow meters. “The non-migratory nature of graphite combined with its antifriction properties makes this grade an ideal additive for parts used in submerged and potable water applications,” Colloids says.

The company also notes that in bearing systems, the use of a correctly formulated graphite modified compound for both stationary and rotating parts reduces the development of static electrical charges during operation. Colloids can also produce graphite and MoS₂ concentrates in other polymers if required.

The company is currently working on the development of more antifriction and wear-reducing formulations for high performance polymers. Upcoming products are likely to include masterbatches containing graphene, thanks to cooperation with the National Institute of Graphene at the University of Manchester.

Compound benefits

Other producers of compounds have also been hard at work coming up with new solutions. Lehmann & Voss and Eurostar Engineering Plastics also highlighted new developments. At the AMI conference. **Lehmann & Voss** Product Development Manager Dr Markus Topp spoke about the tribology of new compounds based on polyetherketoneketone (PEKK), which appear to have some advantages over PEEK compounds,

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Table 2: Tribological properties of the new Star L POM DW1 compound compared to 15% PTFE filled POM

PRODUCT	POM +15% PTFE	Star L POM DW1
TRIBOLOGICAL PROPERTIES / ASTM G133		
Friction Coefficient (25N ASTM G133) - Static	0.21	0.09
Friction Coefficient (25N ASTM G133) - Dynamic	0.25	0.13
Wear Rate (25 N ASTM G133) - (10 ⁶ xmm ³ /N.m)	7	4.8
Low noise	++	+++

Source: Eurostar Engineering Plastics

while **Eurostar Engineering Plastics** Technology Manager Alexis Chopin discussed (among other things) its recently developed Star L DW series based on a new self-lubricating technology. "This family of compounds offers a unique value proposition compared to standard PTFE lubricated compounds," he says.

Chopin highlighted in particular an unfilled POM grade, Star-L POM DW1. "For high-performance engineering components requiring good tribological properties, POM is widely used due to its properties such as low friction coefficient, excellent wear properties, good fatigue and creep resistance and exceptional dimensional stability," he said.

"Internal lubrication is often needed especially for high speed/high load long-term applications," according to Chopin. He says current technologies based on PTFE or silicone oil have various limitations: a high PTFE loading may be required, and PTFE is halogenated (a concern for some specifiers). PTFE also increases density and affects mechanical properties. With silicone oil, there can be issues with migration and contamination.

The new Eurostar self-lubricated POM is halogen-free and is based on a new modifier used at a very low loading (1-4%). Chopin says it provides tribological performance better than POM containing 10-20% PTFE. Wear resistance is higher, CoF is lower, and it is also stable over time.

Density of the compound is lower than a PTFE-modified POM, and the additive has a "limited effect on compound mechanical and thermal properties."

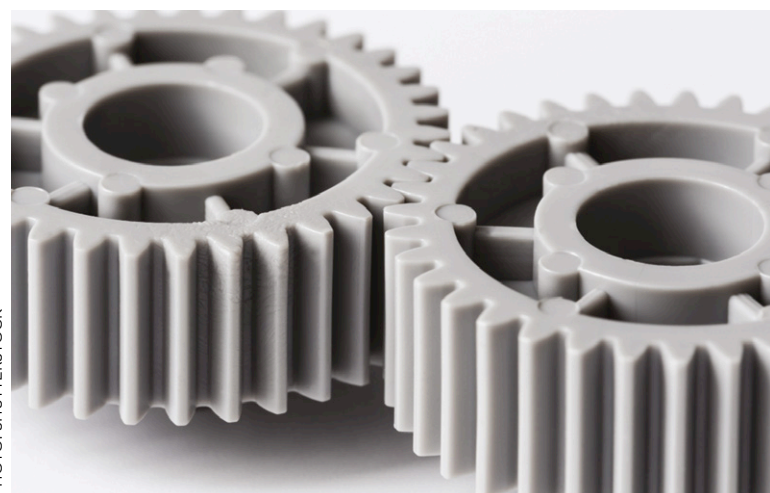
Chopin said that the additive does not migrate, and mould deposits are low. It also helps reduce noise. He cites potential uses in gears and bearings, conveyer systems, sliding and moving parts in general, and hinges.

Not all are moving away from PTFE, though. **Ensinger**, another company specialising in high performance plastics, had one of its spotlight exhibits at Fakuma last year on compounds based on polyetheretherketone (PEEK), including types with special tribological properties. These compounds may contain PTFE and also mineral additives for lubrication.

"At Ensinger, the demand for optimised PEEK formulations has grown continuously in recent years," says Thomas Wallner, Head of Compounds Sales & Marketing. "Originally, the focus was on compounds with improved sliding and friction properties for the automotive industry or mechanical engineering. But also in other sectors, such as the food and electrical industries or medical technology, the requirements in production are increasing and thus the need for innovative solutions."

Ensinger has developed compound formulations for very high loads for components in the automotive industry and in plant and mechanical engineering. It says components made of Tecacomp PEEK TRM "exhibit the lowest possible wear and friction as a sliding element." The company has also developed materials that provide increased mechanical strength.

Below: Internal lubricants must improve slip and wear without compromising mechanical performance



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Driving demand for optimised electrically conductive plastics

Achieving the required electrical conductivity in a polymer while maintaining mechanical properties is the goal of many speciality compounders. Mark Holmes looks at some of the additives available and how they are being used

Applications for electrically conductive compounds can be found in automotive and electrical and electronic devices, through to mining equipment, medical and the HVAC industry. Each has its own particular requirements and is being served by an expanding range of additives designed to deliver the desired conductivity properties. But in all cases expert compounding techniques are required to ensure that electrical conductivity is achieved without drastic loss of mechanical properties.

The market for conductive additives and the use of electrically conductive compounds continues to grow and is set to rise still further. "Currently, conductive additives only account for 2-3% of the overall thermoplastic compounds market," says

Zakhar Bolshakov, Vice-President for Polymers at graphene nanotube manufacturer **OCSiAl**. "However, the trend is that this share will increase significantly, with one of the main drivers of growth being e-mobility. If their application technology is significantly simplified and their use made economically feasible, conductive compounds could definitely have a much broader range of applications."

Cost and performance are the main obstacles, Bolshakov says. "Current solutions do not fully comply with the existing demand for conductive additives in terms of their technological development and economic feasibility. For example, the car dashboard is made of various polymer compounds and accumulates a lot of dust on its surface. If this

Main image: Autonomous cars and the increased use of electronics that brings is one factor driving interest in electrically conductive plastics

PHOTO: OXCSIAL



Above:
OCSiAl's Tuball
graphene
nanotube
additives are
being used in
ventilation
ducting in
mining
applications

plastic could be made permanently antistatic, it would prevent dust accumulation and benefit end users. If antistatic compounds were easier to process, provided stable results and were economically feasible, then we would see a rapid expansion of the conductive compounds market," he says.

"In addition, other key trends include global green technologies - the application of environmentally friendly raw materials and technological processes - where there is a requirement for new products in the field of transportation and a growing demand for high-performance electronics applications," he predicts.

Nevertheless, a major technical issue remains the combination of electrical properties with desirable mechanical characteristics. "Products made by processes as different as injection moulding, extrusion, thermoforming or rotomoulding methods require uniform, stable and permanent conductivity without a negative influence on their mechanical properties," Bolshakov says.

"Furthermore, the combination of electrical characteristics and desirable mechanical properties with transparency or vivid colours is also a key target for the current market. In addition, graphene nanotubes are, probably, the only currently existing agent capable of combining and delivering these properties at a reasonable price. However, we are working on ease of integration. We are widening our product line of graphene nanotube-based masterbatches with a broad technological window that can be easily introduced into various materials," he says.

Simplified processing

In order to simplify single wall (OCSiAl prefers the term graphene) nanotube applications, the company produces a pre-dispersed concentrate - Tuball Matrix - that is said to provide uniform and permanent conductivity as well as maintaining or

improving mechanical properties and preserving colour in a multitude of materials. Currently OCSiAl has developed Tuball-formulated technologies for thermoplastic compounds such as PE, PP, ABS, PVC plastisols, PA and PC.

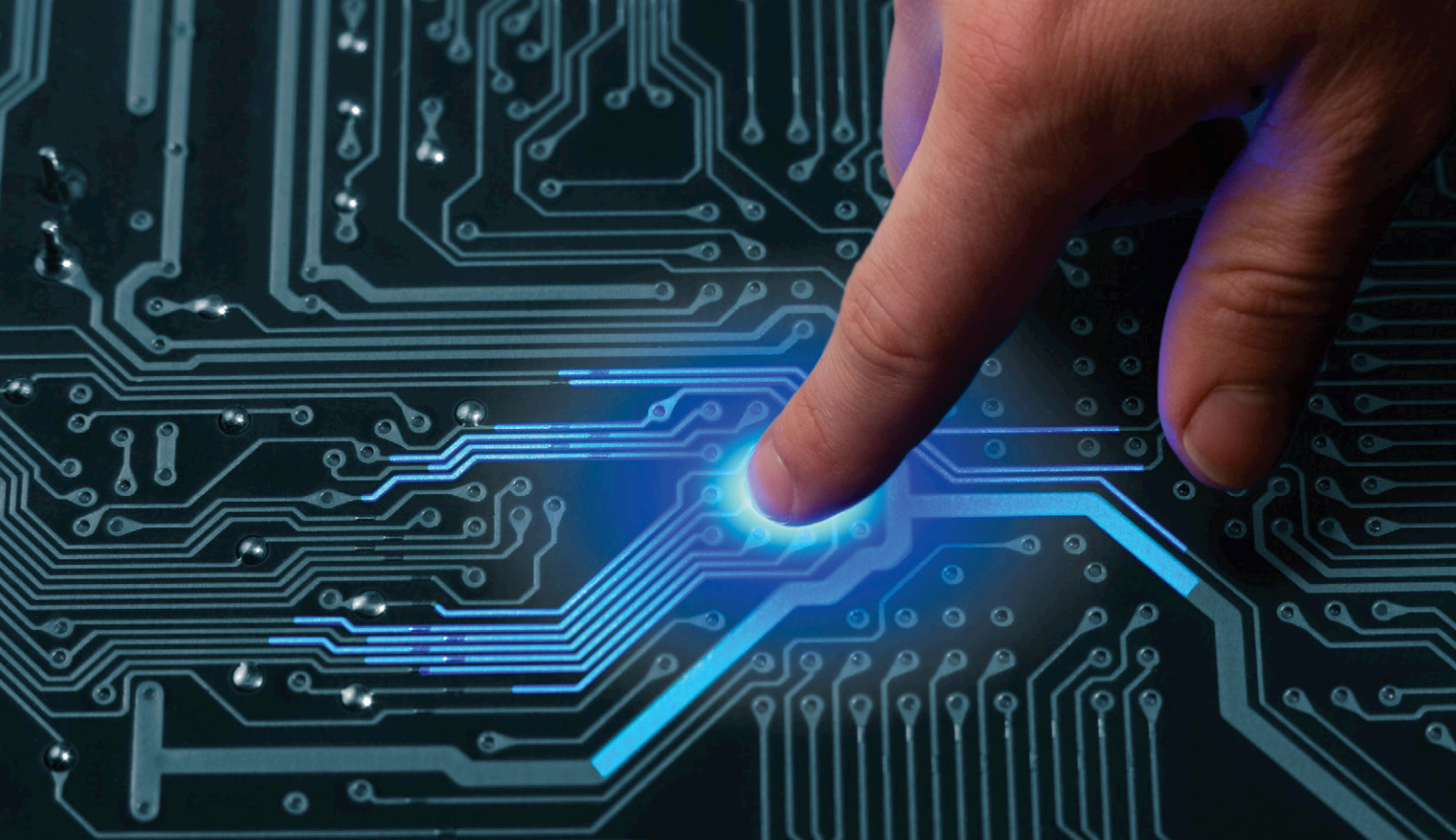
"Successful market products with graphene nanotubes include PVC plastisol-based antistatic ventilation ducting and fibreglass mesh for mining applications, textiles and treadmill belts," says Bolshakov. "For example, 0.4-0.5 wt.% of graphene nanotube concentrate in PVC plastisol-based flexible ventilation ducting and fibreglass mesh for mining applications enables manufacturers to obtain a resistivity of $10^7 \Omega/\text{sq}$ with maintained mechanical performance. Uniform, permanent, stable and humidity-independent electrical conductivity - all guaranteed by graphene nanotubes."

The new nanotube technology is able to avoid the common drawbacks in the usage of conventional antistatic additives, such as carbon black or ammonium compounds, in PVC plastisols. Application of carbon black usually affects mechanical performance, rules out colours and has a negative impact on rheology, while ammonium compounds can become unstable over time and provide only humidity-dependent resistivity.

Another Tuball product in high market demand is Matrix 801, which can be used for antistatic products produced by rotational moulding. "Just 0.7 wt.% of this graphene nanotube concentrate is enough to obtain a permanent and stable surface resistivity of $10^7 \Omega/\text{sq}$ in coloured polyethylene tanks, while 1 wt.% of it achieves a surface resistivity of $10^6 \Omega/\text{sq}$ in black tanks for flammable and explosive liquids and powders," Bolshakov says, adding that mechanical performance is also improved.

"Recent developments include the preparation of conductive LLDPE rotomoulded systems based on a low dosage of Tuball Matrix 801. This has allowed the replacement of typical carbon black compounds by new Tuball-based compounds providing equivalent electrical characteristics but with significantly better mechanical properties, including impact characteristics at low temperature," he says.

According to Bolshakov, developing applications in injection moulding, material enhancement and exploiting the synergistic effect of Tuball nanotubes with various fibres are the main targets of development for 2019. "We have already achieved a number of inspiring and highly promising results in our own and in our partners' labs," he says. "The next steps are for us to scale the technology up and make it simple and economically viable for the industry." 



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Driven by safety

Sebastian Heitkamp, Global Marketing Segment Manager at **Cabot Corporation** also sees the market for electrically conductive compounds continuously growing in various plastic applications. "New developments in electrically conductive compounds are mainly driven by increased safety requirements across many industries," he says. "In addition, as we see automotive manufacturers shift towards lightweighting, plastics continuously replace traditional materials, such as metals, for which new functionalities in electrical conductivity are required."

However, he also highlights the need to minimise the impact of electrically conductive additives on mechanical properties, which requires a combination of more effective and high conductivity additive solutions as well as formulation design expertise. "We have worked with our customers to create solutions for a number of challenges facing the industry," says Heitkamp. "Our latest developments include different polymer types for automotive, packaging and industrial applications. We are designing new formulations which combine various additive solutions to meet specific customer challenges, such as less impact on mechanical properties. Our latest developments include a newly formulated Cabellec CA6483 conductive compound. This novel formulation for ABS extrusion and thermoforming applications achieves very good surface resistivity paired with excellent surface quality."

Cabot's strategy is to develop conductive solutions that exploit the particular benefits of carbon black, graphenes, carbon nanotubes and carbon nanostructures either alone or in "hybrid" formulations. Carbon nanostructures - described as three-dimensional crosslinked networks of carbon nanotubes - are the latest addition to its additive portfolio through the acquisition last year of US-based Applied Nanostructured Solutions from Lockheed Martin. The novel materials, currently produced on a pilot scale, can reduce the percolation threshold of electrically conductive carbon black formulations by creating "bridges" between the particles.

The continued expansion of the global conductive compound market is also forecast by Bruno Douchy, Sales Director of carbon fibre supplier **Apply Carbon/Procotex**. "Market expansion for these compounds is driven mainly by the growing

preference for lightweight, high performance electronic products in a wide range of applications. These include solar cells, packaging, ESD and EMI protection, batteries and capacitors, for example," he says.

"Applications where ESD and EMI protection is required are estimated to be the largest market, while the automotive market is also full of promise. For example, antistatic and conductive plastic compounds have a number of advantages over metals or surfactant coatings. Finished parts are lighter, less costly to ship and easier to handle. The production process is also easier and less expensive due to the elimination of secondary processes, and they are not subject to denting, chipping and scratching," Douchy says.

Tackling cost

However, he says the high cost of production of these compounds is a problem for the market. "The major factor limiting the growth of the conductive compound market is the high cost of production, including high raw material costs and the manufacturing processes. This is why we have developed a sustainable carbon fibre solution. We can offer a wide range of carbon fibres with virtually the same quality characteristics as virgin grades, but at prices 30-50% cheaper."

One of the challenges the company faced was to prevent dust from milled carbon fibres contaminating the production area and potentially causing damage to electrical components. "We developed a milled carbon fibre in granulate form, which offers the best of both worlds - the advantages of milled carbon, as well as working in a dust-proof environment in a highly accurate way."

Procotex says the benefits of the milled carbon granulates include: easy dosing; dust free feeding; mechanical reinforcement; conductivity; low cost; and easy dispersion. "While these carbon fibres have a length of 300 microns, we are also working on granulates with longer fibres of up to 1 mm. This will further improve conductivity levels and the reinforcing capacity of the compounds," Douchy says.

Apply-Carbon/Procotex installed a tailor-made sizing and chopping line in 2015 that produces fibres with a length of 6 mm. The company says extensive tests in both in-house and external laboratories, followed by production scale tests at different compounders, show that the properties of the product are almost identical to virgin grade chopped fibres. The oversized fibres are well bundled using an optimal sizing agent, which is compatible with any specific resin and helps to improve the workability in any application or process.

PHOTO: PROCOTEX



Above: CF MLD 300 G U1 is an easy-to-handle 300 micron carbon fibre granulate from Procotex with a PU sizing

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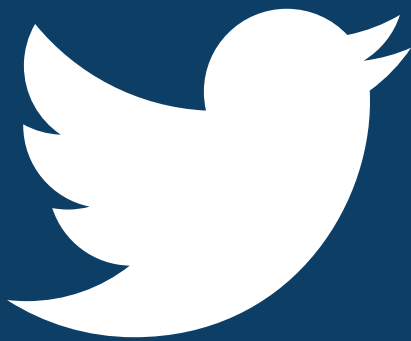
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Premix compound aids diagnostics

Finnish electrically conductive compound producer Premix has validated a new PP compound for production of in-vitro medical diagnostic pipettes using the latest addition to the Borealis medical polyolefin product line.

The new application is based on Bormed BJ868MO high flow heterophasic PP copolymer, which Borealis says was developed to allow customers to achieve full regulatory compli-

ance for production of medical devices such as pipettes more easily. It says that the Medical Device Regulation and In-Vitro Diagnostics Regulation in particular have brought in stricter procedures for conformity assessment.

The new Premix compound offers electrical conductivity along with good impact resistance and easier processing - it can fill parts with a flow length to wall thickness ratio of up to 300 and

at lower holding pressures and melt temperatures than alternatives, according to Premix.

"We are pleased that this constructive collaboration with Borealis has enabled us to establish together a new benchmark for quality standards in in-vitro diagnostics materials," says Noora Kuusisto, Global Business Development Manager at Premix.

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Its carbon fibre products for electrically conductive compounds include milled carbon from 75 up to 300 microns. This is a fine powder which can be mixed with various materials and can have various lengths or sizings and can improve both the conductivity, mechanical properties and dimensional stability of thermoplastic and thermosets. A new milled carbon in granulate form of more than 300 microns is also now available.

Douchy says the company has projects running with major compounders, specialised in technically high performance compounds for automotive, transportation, electrical/electronics, industrial, medical and consumer product applications. "We are looking at developing a sustainable easy dosing carbon fibre with a certain length that can be offered in large quantities and at a very competitive price compared with virgin carbon fibres," he says. "The industry is waiting for such a product to allow more applications to benefit from the advantages of carbon fibres. The automotive industry has the biggest potential for further development."

ESD alternatives

LEHVOSS Group and **Milliken** have collaborated to develop Luvocom ESD compounds optimised with Zelec electro-conductive powder for consistent ESD (electrostatic dissipative) performance. The companies say that aerospace and automotive industries continue to pursue weight reduction and operational cost savings by replacing metals with high performance plastics. This trend presents significant challenges caused by the material interactions between metals and plastics.

Using traditional carbon-based

additives to achieve electrostatic dissipative properties in engineering thermoplastics may result in corrosion at aluminium alloy-thermoplastic interfaces, according to the companies. To overcome this problem, LEHVOSS has developed carbon-free PPS, PEEK and other high-performance ESD polymer compounds. "The success of this new generation of Luvocom ESD compounds results from the combination of our compounding and processing knowledge with the unique properties of Milliken Zelec electro-conductive powders", says Thomas Collet, Marketing Director Customised Polymer Materials at LEHVOSS Group.

Zelec particles combine a dense layer of crystallites of antimony-doped tin oxide on an inert core particle with a silica adhesion coating minimising the risk of the conductive layer being damaged during high shear processing. This core-shell structure creates a highly efficient, cost-effective way of utilising antimony-doped tin oxide to dissipate electrostatic charge. "This robust structure allows our customers to develop durable high-heat resistant compounds with long-term consistent ESD properties", says Dr Philippe Scheerlinck, Senior New Business Development Manager EMEA at Milliken.

Following the announcement last year that it was partnering with Integral Technologies subsidiary ElectriPlast to commercialise its specialty long fibre conductive compounds, **PolyOne** has rebranded the ElectriPlast products as Surround EMI/RFI Shielding Formulations. This portfolio of conductive thermoplastic materials can shield sensitive electronics from both electromagnetic interference (EMI) and radio frequency interference (RFI).

The company says the

Right: LEHVOSS Group and Milliken collaborated to develop the Luvocom ESD compounds using Zelec electro-conductive powders



PHOTO: LEHVOSS

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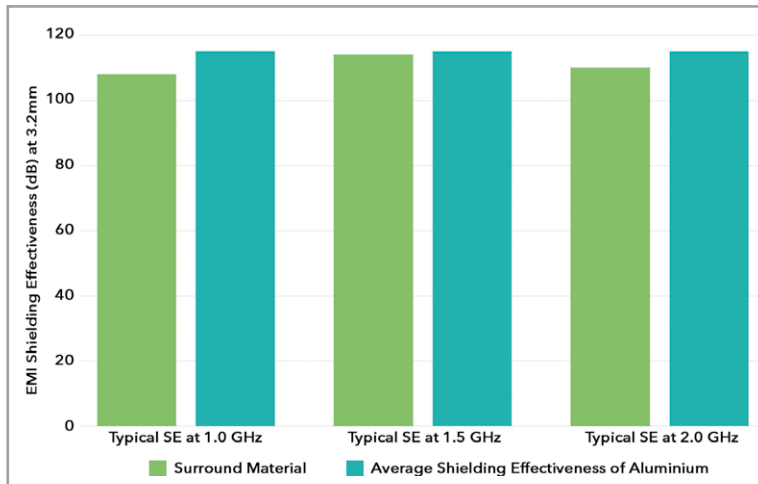


Figure 1: EMI Shielding performance of PolyOne Surround long fibre electrically conductive compounds versus aluminium

Source: PolyOne

Surround long-fibre materials are well suited to housings for advanced driver assistance systems (ADAS). As automakers continue to add ADAS functionality to automobiles, more electronic control units (ECUs), cameras, and sensors are needed and it is becoming increasingly critical to minimise risk of “cross talk” between components. Surround material is lighter in weight and easier to process than traditional materials such as aluminium or copper – the company claims Surround solutions weigh up to 60% less. Injection moulding also permits more complex shapes and imposes fewer design constraints than metallic alternatives.

HVAC applications

Italian technical compounder **Lati** has developed several new electrically conductive compounds for the HVAC industry. Key objectives in this field require constant improvement in performance, such as reduced energy consumption, without compromising safety. Germany-based Wolf is using an electrically conductive Latiohm compound to manufacture the couplings that handle the air-gas blend in condensing boilers.

The company says the application required uniform electrical conductivity sufficient to prevent electrostatic charge accumulation. It selected Latiohm 66-07 PD08 G/30, which uses carbon fibres and specially selected electrically conductive additives. The compound is said to have provided the mechanical strength (100 MPa at 90°C), dimensional stability and long lifetime required to withstand the temperatures found inside the boiler.

Speciality compounder

Right: Lati has developed a number of electrically conductive compounds for the HVAC industry



PHOTO: LATI

Witcom Engineering Plastics has seen demand for electrically conductive compounds grow steadily since the company was founded in 2004. “This is related to the increasing need for safety and technological developments - often requiring EMI shielding - and mainly driven by ATEX requirements and continuous metal replacement,” according to Christine Van Bellinghen, Business Development Manager.

“We have gained significant experience with the development and realisation of conductive compounds, incorporating various types of conductive additives, to be able to cover the whole conductivity range - from 10⁻¹ to 10¹¹ Ohm/sq - including the manufacture of coloured conductive compounds,” she says.

The company works with all commodity and engineering plastics, except PVC, and is not limited to the use of carbon black to impart electrical conductivity, Van Bellinghen says. “Although carbon blacks offer lots of advantages, they also have some limitations, which can be fulfilled by other conductive additives such as carbon fibres or stainless steel fibres. We select the most appropriate conductive additive to provide the best overall properties needed, as each individual conductive additive will bring its specific added properties,” she explains.

“One of our key strengths is to be able to produce conductive compounds that have many other additional functionalities on top of electrical conductivity,” she says.

Sensor shielding

Witcom views its most important market segments in electrically conductive compounds as automotive, industrial, HVAC, safety equipment, measuring equipment and dust extraction. “We see an increasing demand for radar absorbing EMI shielded material for autonomous driving and ADAS sensors,” Van Bellinghen says. “The HVAC industry is rather conservative and can still use a lot of metal, but European players understand the huge benefit of conductive plastics to make axial fan blades and fans for central heating systems.

Last year we also responded to a special customer request to develop a coloured conductive polyamide compound that offered toy compliance. We are now seeing more requests for electrically conductive compounds that also involve food contact compliance.”

Witcom has delivered a number of

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PHOTO: ORION ENGINEERED CARBONS



Above: XPB 633 Beads from Orion Engineered Carbons can provide conductive and anti-static properties in a wide range of polymers

electrically conductive compounds for applications with multiple requirements. For example, it has produced conductive PPA compounds for fans of central heating systems that required ESD protection, high chemical and thermal stability, high strength and stiffness (resistance to strong centrifugal forces), as well as easy processing. It has also supplied conductive PA6 compounds for axial fans for HVAC systems and engine cooling in the mining industry and gas pipelines which required ATEX compliance, reinforcement, halogen-free flame retardancy, grey colour, and good chemical and temperature resistance. Operation from -35°C to 100°C was also required.

A further application was a conductive PA66 compound used to make the housings for communication systems used by firefighters. Requirements included ESD protection and ATEX compliance, colorability, high strength and stiffness, high chemical and thermal stability, low flammability (HFFR, UL94/V0 @ 1.6 mm), easy moulding with high flow, and UV resistance.

Conductive PC/PBT compounds have also been developed for housings for portable digital gas pressure sensors.

The latest introductions from **Orion Engineered Carbons** for conductive applications are Speciality Carbon Black XPB 633 Beads and its high-perfor-

mance, low-compound-moisture- absorption Printex Zeta A Beads for pressure pipes.

The company says that XPB 633 Beads are specifically geared for thermoplastics requiring conductivity and antistatic properties. "XPB 633 Beads provide better conductivity at lower concentration than most conductive blacks," says Joey LeBlanc, Marketing Manager, Polymers, Americas. "In addition, they have excellent dispersion quality, compound melt flow rates and mechanical strength."

Paint improver

The XPB 633 Beads are well suited for production of plastic automotive body parts that require conductivity to ensure trouble-free coating. Other applications include injection moulded parts as fuel canisters, boxes, and electronics housings and trays, and for extruded conductive pipes, profiles and packaging films. They are a universal grade suitable for use in a wide range of polymers including polyolefins and co-polymers, PA, PS, and PVC.

The Printex Zeta A Beads are designed specially for use in PE 100 and PE 4710 pipe for gas and water distribution. The high chemical purity, low sulphur level and purity of the Printex zeta A Beads minimises taste and odour effects while low compound moisture absorption and good dispersion performance ensure smooth, defect-free production. The products also provide good UV protection, according to the company.

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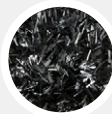
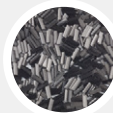


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Polyamides rise to EV challenge



PHOTO: SHUTTERSTOCK

Demand for polyamides in electrical and electronics and automotive continues to grow, with new additive developments key to their success in ever more demanding applications such as electric vehicles. Mark Holmes reports

The market for polyamides continues to expand, particularly in electrical and electronic applications and in automotive applications in Europe, Asia and the US, where the rise of electric vehicles (EVs) is placing new and increasingly stringent demands on materials. Cooling system components for EVs, for example, will need to withstand longer periods of operation as, unlike conventional combustion engines, they function both while the vehicle is in use and during charging cycles. At the same time, ongoing restrictions in supply of the high performance PA66 polymer is encouraging development of PA6 grades capable of meeting more demanding performance requirements.

According to Péter Sebő, Head of Marketing & Market Development at **HPF The Mineral Engineers** (part of Quarzwerke), these major market changes, together with established trends such as metal

replacement, mean real opportunities for additive suppliers. He highlights interest in polyamide compounds offering improved thermal management, electrical discharge and shielding, flame retardancy, and lighter weight while maintaining good mechanical properties. "Our SilaTherm portfolio can increase thermal conductivity, while maintaining insulating properties, for example," says Sebő. "In addition, kaolin can be used as a synergist in flame retardant polyamide systems to optimise the whole compound from a technical and a commercial point of view. Various high performance fillers from our portfolio with different specialities and surface treatments can also be used to improve the mechanical properties, reduce shrinkage, increase scratch resistance and optimise other properties of the polyamide compound."

HPF categorises its additives as functional fillers

Main image:
The emergence of electric vehicles is likely to fuel demand for high performance polyamide compounds

Right: Sectional view of a 40% carbon fibre reinforced PA foamed with Luvobatch blowing agent to achieve a 30% weight reduction

that can enhance a wide range of properties. As well as reducing cost, the company says mineral functional fillers can be used to increase heat resistance and stiffness, and reduce creep, shrinkage and flammability. They can be used to modify specific gravity (density) and flow, while improving abrasion resistance, dimensional stability and thermal conductivity. Mineral functional fillers can also change electrical properties, improve moisture and impact resistance, and modify opacity and gloss. For polyamides, Sebö highlights two examples where mineral fillers can make significant property improvements – thermal conductivity and flame retardancy.

Thermal conductivity relies on three main mechanisms: convection (material independent); conduction (material dependent); and radiation (influenced by the surface and design of the part). A thermally conductive compound can offer a number of advantages over metals, including freedom of design, part integration and the elimination of secondary processes such as painting. An appropriately designed part can also offer lighter weight than aluminium and provide a homogeneous temperature distribution. In a recent case study, Sebö cites a module flange for an HVAC automotive application that was produced in a PA6 compound with a fine, calcined aluminosilicate filler plus coating that resulted in an isotropic thermal conductivity of 1.4 W/mK.

Below: Cooling systems on electric vehicles operate for longer than their combustion counterparts, calling for higher levels of polymer stabilisation

As a flame retardant, Sebö says kaolin offers a number of advantages. Kaolin loses around 14% water at a temperature of 400°C and is therefore suitable as a flame retardant or synergist in flame retardant systems for engineering plastics. It is white in colour, improves impact strength, has low abrasion and is chemically inert. It can also be supplied coated or uncoated and in various particle sizes. In polyamide compounds, kaolin can



PHOTO: LEHVOSS GROUP

be used to partly replace common flame retardants such as phosphates and phosphonates. According to HPF, around 20% of phosphonates or phosphates is typically needed in a 30% glass fibre filled PA to achieve UL94 V-O at a test specimen thickness of 0.8 mm. It is looking at replacing glass fibre with kaolin and/or wollastonite while reducing the amount of phosphonates and phosphate. Further investigations into kaolin as a flame retardant synergist are also underway, with some filler blends being trialled as lightweight fillers as an alternative to hollow glass bubbles.

Changing markets

The **LEHVOSS Group** is also seeing an expanding and changing polyamide market. “There are a number of trends influencing new developments in polyamides,” says Mattias Bragvad, Global Business Team Manager. “Heat resistance and lightweighting are the principal issues in polyamide developments. At present there is a lot of movement towards replacing PA66 with other solutions, but also increasing the temperature resistance of standard PA6. In addition, we are seeing increased interest in our blowing agents, which enable further lightweighting in automotive applications. Furthermore, increasing interest in biaxially oriented PA (BOPA) films is driving new development in this field. Most of these applications benefit from the use of blowing agents for polyamides. This is a major advantage when trying to reduce weight, without losing significant mechanical properties.”

Bragvad says LEHVOSS Group has recently introduced some new masterbatch products in this area. Luvobatch PA BA 1001 and Luvobatch PA BA 1002 are newly developed endothermic blowing agents for polyamides based on PA6. In combination, they are said to reduce the weight of polyamide parts by up to 30%. They work in filled PA compounds and are targeted at injection moulding applications in the automotive sector.

PA PPA 9659 is a newly improved processing aid for PA. Used at a low dosage of 1% in PA film production, both cast and blown, it can help to increase up-time between cleaning as well as



PHOTO: SHUTTERSTOCK

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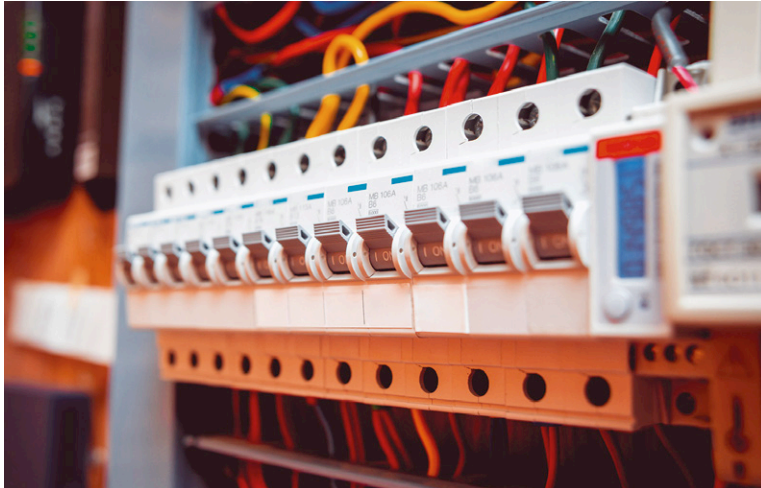
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Above:
Clariant's Exolit
OP 1400 flame
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increase output of the extruders. Luvobatch PA HS 9611 and Luvobatch PA AO 0043 are heat stabilisers/antioxidants for PA claimed to significantly increase in-use temperature stability.

Other new developments include Luvobatch PA AB 9986B, which is a slip/anti-block masterbatch for premium transparency and lowered coefficient of friction in BOPA, and Luvobatch PA FR 0014 and Luvobatch PA FR 0266, halogen-free flame retardant masterbatches based on PA6 and PA12 that can meet UL94 V-0 fire-retardancy in injection moulding and extrusion applications

"Using these masterbatches in standard PA is a cost-efficient alternative to using the expensive ready-to-use compounds offered by many polymer manufacturers," says Bragvad. "Future developments for polyamides will include UV masterbatches, as well as further slip additives."

Clariant developed Exolit OP 1400 to provide high thermal stability and halogen-free flame retardancy for polyamide parts used in EV and traditional vehicle applications. Based on organic phosphinates and suitable for use with reinforced PA6, PA66 and high temperature polyamides, OP 1400 achieves its flame retardant effect through a combined gas phase and condensed phase mode

of action. It can achieve a UL 94 V-0 rating down to 0.4 mm thickness in polyamide compounds, which continue to exhibit good physical and electrical properties. Other benefits include low material density, good colourability and good contrast in laser marking. The company says OP 1400 is suitable for applications in hot and humid environments and has good thermal stability; it says it also offers the broadest processing window within its Exolit OP product range for polyamides.

In a presentation at AMI's recent Performance Polyamides conference (AMI publishes *Compound-ing World*) Kathrin Lehmann, Head of Innovation Management Polymers, Interface and Performance at **Evonik Nutrition & Care**, highlighted the use of organomodified siloxanes to enhance performance and processability of flame retarded or highly-filled polyamide compounds. The potential benefits of using these additives include improved flow behaviour to provide better surface appearance, hydrophobicity giving better electrical properties (CTI), improved char formation resulting in lower burning time, and a compatibilising effect that improves mechanical properties such as elongation and impact strength.

Minerals and glass

At the same conference, Michael Schmidt, TS&D Manager Polymers EMEA at **Imerys Performance Additives**, discussed the use of minerals in conjunction with chopped glass fibre in PA6 compounds to deliver improved properties and processability balance. He said that talc offers isotropic properties and is a nucleator, providing a good balance of stiffness and improving crystallisation temperature, CLTE and flow. Mica offers the highest reinforcement, isotropic properties, CLTE and flow. Wollastonite can provide a good balance of stiffness/strength and impact, superior weld line strength, elongation, HDT and flow. In addition, Schmidt said hybrid formulations can close the

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PHOTO: AKRO-PLASTIC



Above: The slats in this air vent for the BMW Mini are produced in a 30% glass reinforced heat stabilised PA6 from Akro-Plastic

performance gap between pure glass fibre and pure mineral reinforced formulations and improve overall product performance, especially in regard to mechanical properties, dimensional stability, melt flow and moulded part surface appearance. Germany's **Akro-Plastic** recently developed a polyamide complying with European Union regulation EN 45545-2, R6 HL 2 for fire protection of railway vehicles. Akromid C28 GF 25 FRT offers 170 MPa tensile strength and an elongation of 2.5%. Impact strength is above 60 kJ/m² and it has 30% higher flowability compared to PA66 GF 25 FR. The compound offers an 8% density saving over PA66, provides a good surface and can be custom coloured.

The company also recently announced that its Akromid B3 GF30 1 30% glass reinforced heat stabilised PA6 is now being used to produce the two part slats used in the BMW Mini Countryman car. It is the second commercial air vent application for the material, which was first used by truck manufacturer Scania.

According to Akro-Plastic, the key challenge for the Mini application was to provide a high level of dimensional stability and stiffness while maintaining very tight production tolerances for smooth and effective operation. In addition, the parts had to be completely free of sink marks, even around the latching sections.

Global PA66 producer **Ascend Performance Materials** has developed a new Vydyne PA66 designed for automotive lightweighting applications. Vydyne R433H is designed to reinforce down-gauged steel and aluminium used in vehicle body in white (BIW) structures, helping reduce weight without sacrificing safety or comfort. The company says that the new grade improves energy absorption over traditional glass-filled PA66, reducing noise, vibration and harshness (NVH) and absorbing impact energy from crashes. Using it in the BIW structure reinforces the sheet metal, helping manufacturers to reduce weight and improve fuel efficiency. In electric vehicles, where lightweighting and NVH reduction are particularly important, R433H is expected to find application in battery frames and housings.

Right: An automotive cooling water valve made by Mann+Hummel in Grivory HT1VA-35 HYS

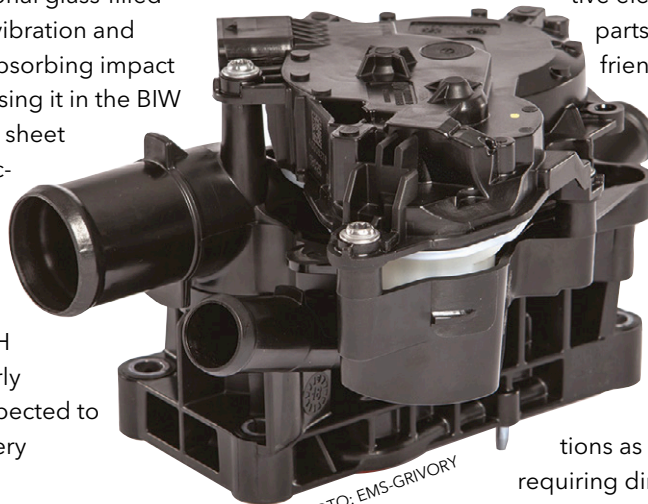


PHOTO: EMS-GRIVORY

High performance PA

Ultramid Advanced T1000 is the latest introduction to **BASF's** high performance polyamide product line. Based on PA 6T/6I, Ultramid Advanced T1000 offers high strength and stiffness with mechanical properties remaining stable at temperatures of up to 120°C (dry) and up to 80°C (conditioned). Due to its partially aromatic chemical structure, it offers high resistance to humidity and to aggressive media - outperforming conventional polyamides and many other PPA materials on the market, according to the company. Advanced T1000 grades also show better resistance to chemicals than conventional aliphatic polyamides, including hot coolants, oils, aggressive fuels, and solutions of road salts containing calcium or zinc salts. Water uptake is also lower than many aliphatic polyamides, resulting in better dimensional stability.

The new polymer is suitable for injection moulding and can be welded to itself and to other PA and PPA materials. BASF expects it to find application in automotive and other industries where resistance to humidity or chemicals is required. These include thermostat housings and water pumps, fuel circuits and selective catalytic reduction systems, actuators and clutch parts in cars, as well as coffee machines, furniture fittings and in construction applications such as water distributors, heating systems and pumps.

Grivory HT is the latest addition to the **EMS-Grivory** polyamide range and is claimed to provide the highest hydrolysis resistance at elevated temperatures. The material is targeted at uses requiring long term resistance to hot water, steam or cooling agents, making it suitable for automotive cooling systems and sanitary applications. According to EMS-Grivory, the Grivory HT1VA grade shows 30% higher retained strength after 12,000 hours in water at 95°C than a traditional PPA. Grivory HT can also be used in automotive electrical and electronic parts, where the 'electro-friendly' stabilisation technology prevents problems with salt efflorescence and the corrosion it causes under warm and moist conditions.

Grivory HT is available in two versions - for use in automotive applications as well as applications requiring direct contact with food

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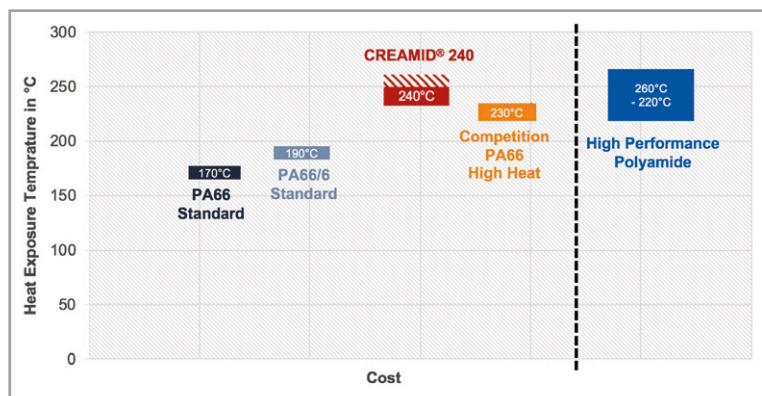
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Long term service temperature versus cost for Creamid 240 high heat resistant PA66 compared to alternatives

Source: Teknor Apex

and drinking water. In automotive, for example, Mann+Hummel manufactures a cool-water valve for Hyundai-KIA-Motors in Grivory HT1VA-35 HYS. This application requires good hydrolysis resistance at elevated temperatures, resistance to cooling system chemicals, and high dimensional stability. The Grivory HT1VA-35 HYS also offers good demoulding performance, so tooling with complex geometries and undercuts can be used.

FWA products are approved for use in direct contact with foodstuffs and drinking water in a variety of applications and consumer goods. Two grades are available: Grivory HT1VA-4 FWA (40 wt.% glass fibres) and Grivory HT1VA-5 FWA (50 wt.% glass fibres). In comparison to conventional Grivory HT1V-FWA grades approved for use in direct contact with foodstuffs and drinking water, these two products provide significantly higher toughness and reliability and extend utilisation limits with regard to temperature and life expectancy.

Optimising cost

A new series of high-heat glass-reinforced PA66 compounds from **Teknor Apex Company** is claimed to bridge the cost-performance gap between standard heat-resistant polyamides and costly speciality polymers, providing a more economical alternative for automotive and other metal-replacement parts.

The company says the Creamid 240 H7.5 Series compounds provide the strength and stiffness of highly glass filled engineering polymers, while maintaining critical mechanical properties even after continuous service at temperatures of 240°C. Currently available grades come with glass fibre contents of 35, 50, or 60% and are said to display better property retention than standard PA66 compounds with a similar level of glass fibre reinforcement.

Teknor Apex says the materials offer considerable cost saving potential. Per kilogram cost is said to be around 30% less than high-performance polymers such as polyphthalamide (PPA) or PA46 while providing comparable performance. "Additional cost savings with Creamid 240 H7.5 compounds are achievable in processing," says Dr Hartmut Elsässer, Global Director of Technology for Engineering Thermoplastics at Teknor-Apex. "These new materials exhibit lower melt and mould temperatures than competing PA66 compounds and high-performance products like PPA, providing economies in terms of energy consumption, cycle times and tooling requirements."

The new compounds have processing temperatures in the range of 280-300°C and mould temperatures of 80-110°C, while the corresponding ranges for PPA or PA4.6 are 330-350°C and 130-150°C. Teknor Apex recommends Creamid 240 H7.5 compounds for automotive under-hood components such as charge air cooler end caps, air intake manifolds, quick-fit connectors, radiator end tanks, turbo air ducts and resonators, oil pump wheels, EGR valves, and thermostatic casings. Other possibilities include electronic connectors, diode carriers, and bobbins, as well as consumer products such as lamp sockets and connectors.

"While metal-replacement continues to drive demand for polyamides in the automotive market, performance-boosting technologies such as turbocharged engines and advanced transmission systems place stricter requirements for heat resistance, chemical resistance, and reduced water absorption," says Markus Krippner, Director of Sales and Marketing. "These forces, along with the overriding industry effort to reduce vehicle weight, are driving Teknor Apex investment into new polyamide technologies."

Lightweighting requires materials that provide high strength, low levels of creep, and excellent processability to fill complex and often heavily-ribbed designs. Krippner says Creamid 240 H7.5 meets these demands.

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Material handling gains deliver greater precision

The nature of compounding operations is that a very wide range of materials need to be handled efficiently and effectively. Fortunately, suppliers of all types of materials handling equipment are continuing to make improvements in accuracy, ease of use, and reliability and several now also open the doors of their laboratories to let customers try out new solutions before making a purchase decision. This article takes a look at some of the latest developments.

DPK is **Moretto's** latest loss-in-weight feeder, which is said to be well suited for the dosing of small quantities of colorant or additives into a wide range of base materials. The company says the unit offers extremely accurate dosage control, even at very low rates, while the hardware and software together - the load cell technology and control algorithm - are claimed to make the DPK virtually immune to vibrations. This helps achieve improved dosage precision.

In the DPK unit, the colorant masterbatch or additive to be dosed is contained in a hopper with transparent shock-resistant acrylic walls, which makes for easy viewing of the material level. The hopper is also easily removed with no tools for replenishment or additive changeover. The DPK unit features a simple touch screen interface from

Efficient and effective movement and feeding of materials is essential in the modern compounding operation. Peter Mapleston takes a look at the latest developments in this area

which it is possible to store and recall individual recipes. It also offers Ethernet and RS485 connections and is prepared for MOWIS (Moretto's self-configurable integrated supervision and management system that uses object-oriented programming tools). MOWIS enables remote control of complex systems in real time, allowing supervision of plant status and of each connected device. It has dedicated modules for conveying, drying, dosing, storage, and cooling.

Gravimetric options

With its Spectroflex V dosing system, **Motan-Color-tronic** makes it possible for volumetric and gravimetric dosing to be combined on a single unit platform in its product line for the first time. Spectro-

Main image:
Coperion designed and installed this compounding plant, including full materials handling, for Finnish electrically dissipative compound producer **IonPhase**

Right: The DPK is the latest loss-in-weight feeder from Moretto

flex is a modular dosing system suitable for powders, granules, pellets, regrind, flakes and fibres. The equipment is said to be easily adapted to different material properties. Until now, all Spectroflex dosing modules have been volumetric, but the Spectroflex V makes a gravimetric dosing module available. It uses the same base and exchange modules as the volumetric options and is also suitable for granules, regrind, powder and flakes.



Pipework is usually manufactured in stainless steel, but Motan-Colortronic now also offers specially hardened, surface-treated distribution branches that have been designed for conveying particularly abrasive materials such as fibre reinforced granules. These are also suitable for problematic recycling materials.

The company has also upgraded its control software. The LINKnet 3.0 system, which handles system

Below: The modular construction of the Motan-Colortronic Spectroflex dosing units makes for simple reconfiguration

Depending on the feed material and the unit version, throughputs of between 0.7 to more than 3,000 litres/h are possible with tight dosing tolerances. Free-flowing and non-free-flowing materials can be handled.

“Due to the same technical basis of the volumetric and gravimetric systems, little training is required for production or to switch between materials and the two dosing technologies,” the company claims. Use of exchange modules also eliminates the need for the system to be stopped for cleaning during material changes. As a consequence, modification of the set-up is said to be quick and easy.

The Spectroflex V gravimetric dosing unit is controlled via Motan-Colortronic’s Gravinet SF system, which provides network-compatible control for up to two dosing modules. The company says the DMS load cells are equipped with separate CAN-bus interfaces.



utilisation and recipe management, includes functions such as provision of process data and archiving for subsequent systems. Its modular structure enables it to be extended for the implementation of specific customer requirements at any time.

Finally, the company highlights its new ALARMcollector, which it says provides a simple and cost-effective way to centrally display alarms in the system. “In addition to the ease of use and setup of the digital display of alarms, the new ALARMcollector boasts a sleek design and user-friendly interface,” the company claims. Alarm outputs can be directed to any Internet-enabled device.

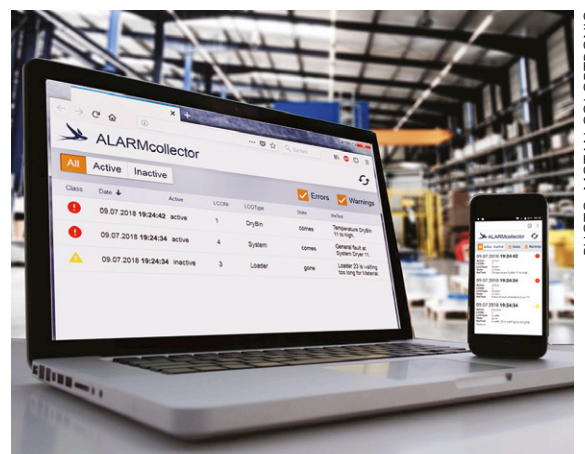
Mixing in bulk

Coperion’s latest mechanical bulk material mixer is the Mix-A-Lot, which it offers as an optional addition to its compounding plants and manufactures in three sizes for throughput rates up to 5 tonnes/h. The unit is said to ensure particularly efficient, high-speed and gentle homogenisation of the fed material. The company adds that an optimised rotor design leads to good mixing performance and short mixing times, which means very little particle

Right: Motan-Colortronic’s ALARMcollector links to any web-connected device to provide plant-wide real-time alarm alerts

‘Clever’ controllers

Motan-Colortronic has also been upgrading various modules for its conveying, drying, dosing and mixing equipment, adding what it describes as “clever” functions and improving lifetimes. One example is the Metroconnect U/C manual coupling station for its vacuum conveying systems, which provides what the company says is a cost-effective entry into central material supply. It is claimed to be easy to use, safe and reliable, even when asked to handle difficult materials. There are two versions, one uncoded and the other coded with RFID technology.



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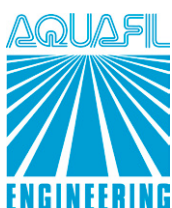
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Right: Coperion's Mix-a-Lot weighs and mixes components to simplify plant feeder configuration

damage or heating of the product. "Up to now it has generally been standard practice to feed each individual component to the extruder through a separate differential loss-in-weight feeder with a buffer hopper," the company says. "However, using this technique, the new Mix-A-Lot first produces the specific pellet mixture, for which one single loss-in-weight feeder is then sufficient." The weighing function of the mixer ensures accurate recording of the weight of each component fed in. The unit is vacuum and pressure-resistant, making direct pneumatic feeding possible without the need for a separate reception bin for pneumatic conveying.

"This simplified plant concept allows the reduction of investment and maintenance costs compared to conventional systems," according to Coperion. "The cleaning effort during changes of product has been greatly reduced, and much less space is required above the extruder."

Measuring fluids

Bronkhorst, a specialist provider of low-flow fluidics handling equipment, was one of several suppliers from the sector exhibiting at the Compounding World Expo in Essen, Germany, last year. Its offering encompasses standard and customised mass flow and pressure meters, as well as a broad range of controllers for gas and low-flow liquid applications.

Angela Puls, responsible for sales and technical service at the company, says there are several reasons for using one of its Coriolis instruments to provide precise additive dosing. "Additives are frequently added by use of needle valves, which is inexpensive but always has a risk of malfunction because of fluctuations within the process - pressure and temperature for example," she says. "With its Cori-Fill dosing technology, Bronkhorst offers an



easy-to-use setup to ensure the required accuracy and reproducibility."

A Coriolis flow meter contains a tube which is energised by a fixed vibration. When a fluid passes through the tube, it produces a change in the vibration, and the tube twists, resulting in a measurable phase shift. From this measurement, a linear output can be derived that is proportional to the flow. As well as measuring the phase shift in frequency between inlet and outlet, the Bronkhorst meters can also measure changes in natural frequency, which are directly proportional to the density of the fluid. Measurements of mass flow rate and density can then be used to calculate the volume flow rate.

As the measurements are independent of what is within the tube, the Coriolis principle can be applied to any fluid, irrespective of whether it is a liquid or a gas. This differentiates the Bronkhorst meters from thermal mass flow meters, which are dependent on the physical properties of the fluid.

Combining a small Cori-Flow mass flow meter with a pump or a suitable valve, allows fluids to be dosed continuously or in batch mode with high reproducibility. "These systems can be integrated or used as an add-on in already existing processes and production lines," says Puls.

Below: Mini Cori-Flow mass flow meters from Bronkhorst provide improved fluid dosing control over displacement pumps

Dosing accuracy

Her colleague James Walton explains that a Coriolis mass flow meter may still be a useful addition when using a dosing or metering pump. "Traditionally, and in most cases we see, dosing or metering pumps are believed to be accurate because the theory is that a known pump head displacement will move a known volume over a known time, giving a known delivered volume," he says. "In practice however, it will never achieve a high level of accuracy, with deviations of 10-15% being normal."

Inaccuracies are caused by changes in numerous process conditions, such as temperature and pressure variation, air entrapment, and component

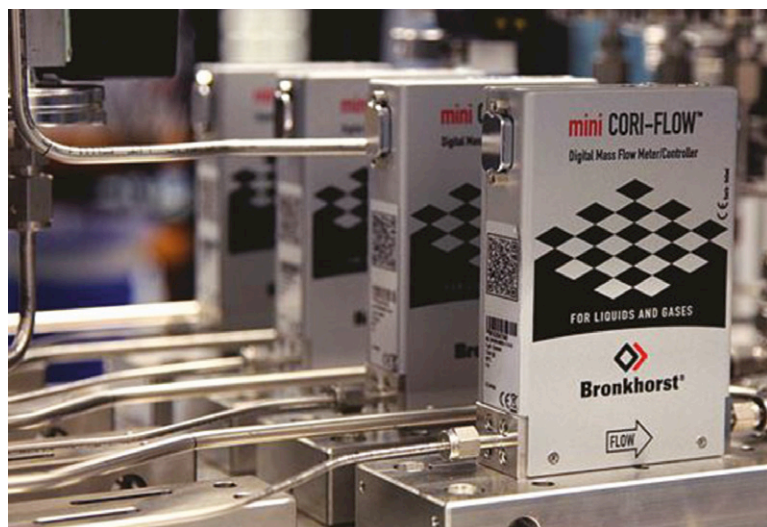


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Right: Inside Coperion's materials handling test facility at Weingarten in Germany

wear. One way to improve accuracy is to add a flow meter between the pump and the process, taking information from the flow meter to adjust the speed of the pump, according to the Bronkhorst engineering team.

Traditionally, this would be managed with an analogue output signal from the flow meter fed into a separate PID controller that compares the real flow signal to the desired flow. The controller can then adjust the speed of the pump to achieve the desired dose or flow. While this solution will mitigate the original issues, it introduces new ones, says Walton. For example, there may be a slow flow signal due to signal filtering in the PID controller; or a slow pump response due to extra control relay. Extra components also increase complexity, and the time to achieve stable flow can be long. There is also the question of the extra cost to be considered in any project.

An alternative option is to carry out direct mass flow measurement with a flow meter with built-in PID control that can drive a pump to achieve the desired dose or flow. "With this solution you do not need to include the pump in the control system, just give a set point demand to the mass flow meter and it will drive the pump to achieve the desired dose or flow," Walton notes.

Testing times

Several developers and producers of bulk handling systems have test facilities that are open to customers as well as being used for internal R&D purposes. Coperion claims to have some of the most advanced materials handling trialling capabilities across its facilities at Weingarten in Germany and at



PHOTO: COPERION

the Bulk Solids Innovation Center at Salina in the US. The company can run material heating, cooling, blending and mixing trials, as well as bulk conveying (it claims to have a total of 2,000m of conveying lines across its test locations able to handle capacities up to 300 tonnes/hr).

Last year, the company also took its materials handling capabilities on the road in the US in the form of its Traveling Equipment Display. The truck-based showroom allowed the company to

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Ergomec joins Italy's Plastic Systems group

Industrial plant specialist Ergomec, based near Verona, Italy, last year became part of the Plastic Systems group. The company, which designs and builds pneumatic bulk material conveying systems for powders and granules, complements its new owner's capabilities in process automation and plastics ancillary equipment.

Ergomec joins Plastic Systems and three other companies within holding company Pegaso Industries. "The Pegaso brand is now one of the global leaders of the sector, and we are not only the youngest of these, but also the only one that boasts diversified production, and can thus serve both large industrial groups and average-sized processing industries", says President Rinaldo Piva.

Aside from Plastic Systems and Ergomec, other companies within Pegaso include Blauwer (founded four years ago to produce refrigeration systems, heat pumps and temperature control units), PET Solutions (packaging plant) and Steelsystems (steel technologies).

➤ www.pegasoindustries.com

take its latest feeding, conveying and system components direct to the customer. First visits commenced in October and the display items included a twin screw feeder, Smart Weigh Belt feeder, a Bulk Solids Pump feeder, and a range of diverter and rotary valves.

In Belgium, **J-Tec Material Handling**, which specialises in conveying systems as well as mixing and product characteristic determination, offers its laboratory for carrying out all sorts of testing, including pneumatic and mechanical conveying, sieving, mixing, dosing, dedusting, dissolving of solids into liquids, and more. Equipment is available for discharging bags, bulk bags and containers. Pneumatic conveying can be tested over a distance of up to 450m. The test facility offers the possibility for dosing of bulk materials, gravimetric and volumetric, batch and continuous, with LIW feeders or J-Tec's patented dosing valves. There is also a deduster with a capacity of about 1 tonne/h capable of maintaining a final dust content of no more than 20 ppm.

Conveying trials

The **Zeppelin Systems'** test plant in Friedrichshafen, Germany, is used for performing conveying tests with bulk solids that are processed in various industries. Pneumatic conveying tests, either dense phase or dilute phase and with or without additional bypass systems, can be carried

out with various conveying pipe diameters and over conveying distances up to 460m and at capacities up to 150t/h.

All related components, such as pressure vessel conveyors, rotary feeders, suction hopper loaders, metering units, diverter valves, filters, elutriators or screeners, are available in different sizes and can be tested. In addition, special test set-ups for hydraulic conveying, for fines generation tests and for filter tests are installed.

For tests relating to silo technology, Zeppelin has a variety of gravity blenders and fluidised bed blenders with volumes ranging from 3 to 35m³ for powders and pellets, as well as silos equipped with a range of discharge aids and a degassing system including the capability to heat or cool the bulk solids.

Flow research

The **Wolfson Centre** for Bulk Solids Handling Technology in Chatham in the UK specialises in all aspects of flow, handling and processing of powders and bulk materials. A plant that extends over 450m² includes just about everything that is found in a real processing and logistics chain, the centre says, including pneumatic conveyors with pipelines of various sizes, belt and mechanical conveyors, hoppers and silos, blenders and feeders of various types, continuing through size reduction and into environmental test facilities and control systems. Many of the tests and models have been developed exclusively at the Wolfson Centre, which is part of the University of Greenwich.

The pilot plant is used extensively for assessing if new or reformulated materials will go through existing systems and, if not, what changes will be needed to accommodate them, setting up short production runs to test formulation and manufacturing proposals, and testing proposed new handling systems. The laboratories are available to anyone in the bulk solids industry either to test their own materials using the centre's equipment, under supervision, or to provide samples to allow the centre to carry out the testing on their behalf.

CLICK ON THE LINKS FOR MORE INFORMATION:

- www.moretto.com
- www.motan-colortronic.com
- www.coperion.com
- www.bronkhorst.com
- <https://processengineering.katoennatie.com/> (J-Tec Materials Handling)
- www.zeppelin-systems.com
- <http://www.gre.ac.uk/engsci/research/groups/wolfsoncentre/home> (Wolfson Centre)

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AMI's 11th PVC Formulation conference takes place in Cologne in April, providing a meeting point for the European PVC industry. We preview the event

Formulating ideas for PVC

PVC may be one of the longest established polymers but it is also one of the most versatile, with material and technological innovations ensuring that it continues to adapt to changes in regulation and new performance demands. AMI's 11th PVC Formulation conference, which takes place in Cologne in Germany on 1-3 April 2019, will once again provide the forum to learn more about the latest market, material and technological developments impacting the European flexible and rigid PVC industry.

PVC Formulation 2019 brings together industry-elite speakers from across the entire supply chain with the aim of identifying opportunities and overcoming obstacles in the international PVC industry. The two-day agenda includes developments in plasticisers, innovation in additives, strategies for cost-reduction and performance improvement, as well as an update on PVC industry regulation and the latest sustainability initiatives. This article takes a more detailed look at the speaker line-up and topics.

PVC Formulation 2019 will be opened by **Thomas Hülsmann**, Managing Director at industry association **AGPU** in Germany, who will look at the latest market trends and key applications with a focus on plastics strategy and current status of regulations. He will also share the results of the

German 2019 PVC survey and look at the achievements of the vinyl industry in the context of markets, political debate and regulation. He will be followed by **Yves Heroes**, Director Market Intelligence at **Kem One** in France, who will discuss the impact of the current trade wars on the supply and price development of PVC resin as part of a rounded market overview.

The conference will then move on to discuss plasticisers. **Perry Walters**, Technical Manager at **European Plasticisers** (part of CEFIC) in Belgium, will give an overview on the safe and sustainable use of the wide range of plasticisers which are available on the market today, touching also on regulatory developments. Then **Megan Kravec**, Business Development Manager at **Valtris Specialty Chemicals** in the US, will present a detailed examination of the properties of a novel low-volatile cyclohexanoate fast-fusing plasticiser. **Matheus Oliveira Loyola de Souza**, Technical PVC Engineer at **Unipar** in Brazil, will provide a performance comparison between phthalate and non-phthalate plasticisers in PVC applications. And the final presentation in the session will be given by **Anders Magnusson**, Technical Market Development Manager at **Perstorp** in Sweden, who will discuss the sustainability, performance and safety characteristics of polyolester plasticisers. ➤

Main image: PVC Formulation 2019 will explore market, regulatory and technology developments affecting the PVC industry



Expert speakers at PVC Formulation 2019 include (clockwise from left) **KemOne** Director of Market Intelligence **Yves Heroes**, **European Plasticisers** Technical Manager **Perry Walters**, **Innovyn** Technical Marketing Development Specialty Vinyls **Jean-Christophe Lepers**, **BASF** Vice President Regulatory Affairs/Advocacy Industrial Petrochemicals Europe **Dr Rainer Otter**, and **Vinylplus** Technical and Environmental Affairs Senior Manager **Dr Vincent Stone**



Moving on to resin and additive innovations, the next session of the conference will be opened by **Dr Bernhard Pelzl**, Head of Group R&D at **Chemson Polymer-Additive** in Austria, who will examine some of the newest trends in highly-filled PVC compounds. Then **Wouter Devriese**, Global Manager Technical Service TempRite Engineered Polymers at **Lubrizol Advanced Materials** in Belgium, will explain how addition of CPVC resin to PVC formulations can enhance material performance. And **Tony Gaukroger**, Director at **Colourtone Masterbatch** in the UK, will detail how infrared reflective colours can be used to extend the service life of PVC building products.

Jurgen Hartmann, Managing Director at **Add-Chem Germany**, will review how CPE can be applied as a cost-effective impact modifier for high-quality PVC formulations. **Dr Bernard Cora**, TS&D Director at **Dow France**, will compare different impact modifier types for outdoor rigid PVC formulations. And an insight into developments in bio-based lubricants for rigid PVC extrusion applications will be delivered by **Dr Christian Mueller**, Global Technical Market

Manager Green Polymer Additives at **Emery Oleochemicals** in Germany.

The second day of PVC Formulation 2019 will be opened by **Dr Timo Seibel**, Head of Group Product Development at **Chemson** in Germany, who will look into the future with an analysis of the potential for PVC in additive manufacturing (3D printing) applications. Then **Dr Andreas Winter**, Senior Technical Service/Senior Account Manager and **Dr Michael Fischer**, Technical Service, Account Manager at **Vinnolit** in Germany, will present an overview of copolymer systems. And **Jean-Christophe Lepers**, Technical Marketing Development Specialty Vinyls at **Innovyn** in Belgium, will speak about vinyl resins to meet future automotive sealing requirements.

The focus will then turn to flame retardancy. **Dr Yann Bourgeois**, Product Manager at **Huber Engineered Materials** in the US, will explore the potential of molybdates in improving flame and smoke properties in PVC and explain how that fits into the context of new regulations. Then **Ian Yates**, Business Development Manager UltraCarb at **LKAB Minerals** in Germany, will review the latest developments in application of huntite-hydromagnesite in flame retardant formulations.

The final session of the conference will address legislation and sustainability issues. It will open with an examination of the new 3R challenge for the chemical industry - Research, Rebuttal and Regulations. This will be given by **Dr Rainer Otter**, Vice President Regulatory Affairs/Advocacy Industrial Petrochemicals Europe at **BASF** in Germany. He will be followed by **Dr Vincent Stone**, Technical and Environmental Affairs Senior Manager at **Vinylplus** in Belgium, who will discuss the voluntary commitments of the European PVC industry in the context of the EU circular economy. And the conference will be brought to a close by **Jan Mervart**, REACH Specialist R&D at **Deza** in the Czech Republic, who will detail the DEHP authorisation and restriction process from a manufacturer's perspective.

About PVC Formulation Europe 2019

Running in Cologne in Germany on 1-3 April 2019, AMI's 11th PVC Formulation conference once again provides a meeting, learning and networking point for the entire PVC industry supply chain. Expert speakers will come together to identify key global market trends influencing the PVC supply chain and to explore developments in resins, plasticisers and additives for production of PVC compounds.

Aside from its formal presentations, this international conference includes a mini-exhibition while informal breaks throughout the two-day event allow attendees to exchange ideas and develop new business contacts. Further networking opportunities are available at the optional informal conference dinner.

To learn more about PVC Formulation 2019, to book your place, or to find out about sponsorship or exhibition opportunities, visit the [conference website](#) or contact Conference Organiser Rebecca Weir.

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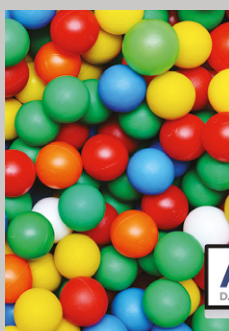
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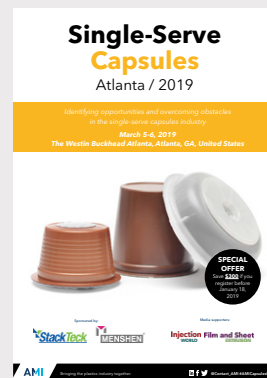
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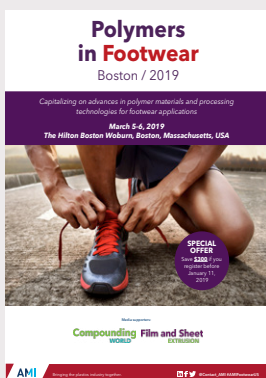
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Click on the relevant brochure cover or link to download a PDF of the full conference programme

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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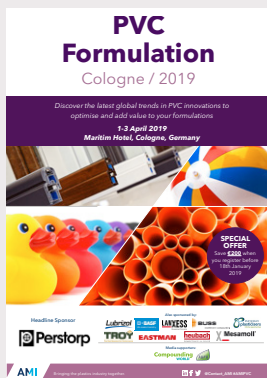
POLYMERS FOR OIL AND GAS ENGINEERING



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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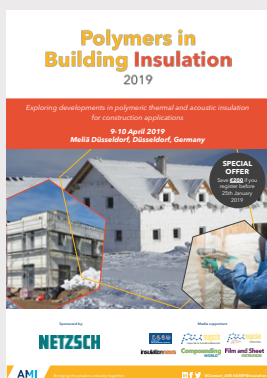
FIRE RETARDANTS IN PLASTICS 2019



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

Polyram Plastic Industries Ltd

Head office location:	Moshav Ram-On, M.P Gilboa, Israel
Date founded:	1986
CEO	Yuval Peleg
Ownership:	Public Limited Company
No. of employees:	180
Sales 2017:	€138m
Plant locations:	Ram-On and Afula in Israel; Tianjin in China; Evansville in the US
Profile:	Polyram Plastic Industries (Polyram) is headquartered in Ram-On in Israel and operates four production sites across three countries - two in Israel and one each in China and the US. It also has subsidiaries located in Spain, France, Germany, Italy and Russia. The company is split into four divisions: Bondyram Functional Polymers; EP Engineering Plastics; Polytron Long Glass Fibres; and Ramclean Purging Agents. It specialises in supplying high performance thermoplastics compounds as 'off the shelf' products along with customised compounds.
Product line:	Polyram offers an extensive portfolio of compounds including PE and PP, PS, ABS, ASA, SAN, POM, PC and PA6, PA66 and PA12. It also offers blends such as PBT/ASA, ASA/ABS, PA/ABS, PBT/AB, PC/PBT; PC/ABS, PA/PE, PA/PP, PPE/PS and PPE/PA. The product line includes glass reinforced, mineral filled, flame retardant, impact modified, heat stabilised and high heat UV stabilised, lubricated, coloured, hydrolysis resistant and water resistant.
Product strengths:	Polyram produces for an extensive range of industries and applications. Its broad spectrum of compound grades means it can offer products to meet the needs of most customers.

To be considered for 'Compounder of the Month' contact Elizabeth Carroll: elizabeth.carroll@ami.international

Compounding FORTHCOMING FEATURES WORLD

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

March 2019

Twin-screw extruders
Natural fibres
Special effect pigments
Computer modelling software

April 2019

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

Editorial submissions should be sent to Chris Smith: chris.smith@ami.international

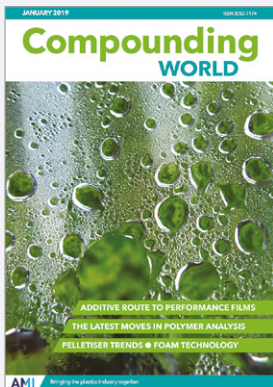
For information on advertising in these issues, please contact:

Claire Bishop: claire.bishop@ami.international Tel: +44 (0)1732 682948

Levent Tounjer: levent.tounjer@ami.international Tel: +44 (0)117 314 8183

Keep informed: read our latest editions

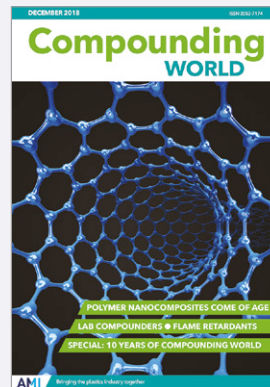
AMI publishes five process-specific FREE plastics industry magazines. Simply click on the cover below to read each magazine. Or download the issue in the relevant Apple or Android app



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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Compounding World December 2018

The 10th anniversary issue of Compounding World in December marked 10 years of the magazine with a look back at the main stories of the past decade. Plus there are features on lab compounders, nanocomposites and flame retardants.

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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.

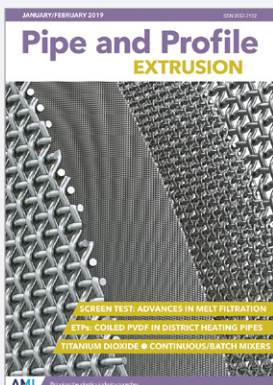
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Plastics Recycling World November/December 2018

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

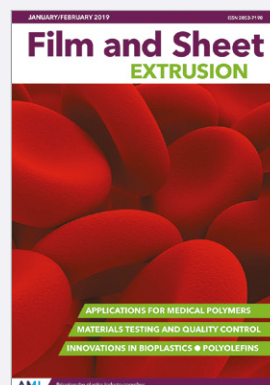
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Pipe and Profile January/February 2019

The January/February edition of Pipe and Profile Extrusion features a study on the feasibility of using coiled PVDF for slipline rehabilitation of district network heating pipes. Plus features on titanium dioxide, melt filtration and mixer technology.

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Film and Sheet 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	28 February - 4 March	Indiaplast, Delhi	www.indiaplast.org
	10-12 March	Asiamold, Guangzhou, China	www.asiamold-china.com
	12-14 March	JEC World, Paris, France	www.jeccomposites.com
	12-15 March	Pro-Pack Africa, Johannesburg, South Africa	www.propakafrica.co.za
	12-16 March	Koplas, Goyang, Korea	www.koplas.com
	19-21 March	EU Coatings Show, Nuremberg, Germany	www.european-coatings-show.com
	25-29 March	Plástico Brasil, São Paulo, Brazil	www.plasticobrasil.com.br
	26-28 March	PlastPrintPack Nigeria, Lagos	www.ppp-nigeria.com
	28-30 March	Mecspe, Parma, Italy	www.mecspe.com
	2-5 April	Plastimagen, Mexico City	www.plastimagen.com.mx
	8-12 April	Feiplastic, Sao Paulo, Brazil	www.feiplastic.com.br
	10-12 April	Utech Las Americas, Mexico City	www.utechlasamericas.com
	8-9 May	Compounding World Expo, Cleveland, US	www.compoundingworldexpo.com/na
	8-9 May	Plastics Recycling World Expo, Cleveland, US	www.plasticsrecyclingworldexpo.com/na
	8-9 May	Plastics Extrusion World Expo	www.extrusion-expo.com/na
	8-9 May	Plasttechnik Nordic Malmö, Sweden	www.easyfairs.com
21-24 May	Chinaplas 2019, Guangzhou, China	www.chinaplasonline.com	
21-24 May	Moulding Expo, Stuttgart, Germany	www.moulding-expo.com	
28-31 May	Plastpol 2019, Kielce, Poland	www.targikielce.pl	
11-12 June	PDM Event, Telford, UK	www.pdmevent.com	
19-22 June	Interplas Thailand, Bangkok	www.interplasthailand.com	
16-23 October	K 2019, Dusseldorf, Germany	www.k-online.com	


AMI CONFERENCES

26-27 February 2019	PVC Formulation USA, Pittsburgh, PA, USA
5-6 March 2019	Long Fiber Thermoplastics USA, Dearborn, MI, USA
5-6 March 2019	Polymers in Footwear USA, Woburn, MA, USA
5-7 March 2019	Cables 2019, Dusseldorf, Germany
14-15 March 2019	Masterbatch Asia, Bangkok, Thailand
2-3 April 2019	Fire Retardants in Plastics 2019, Pittsburgh, PA, USA

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

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