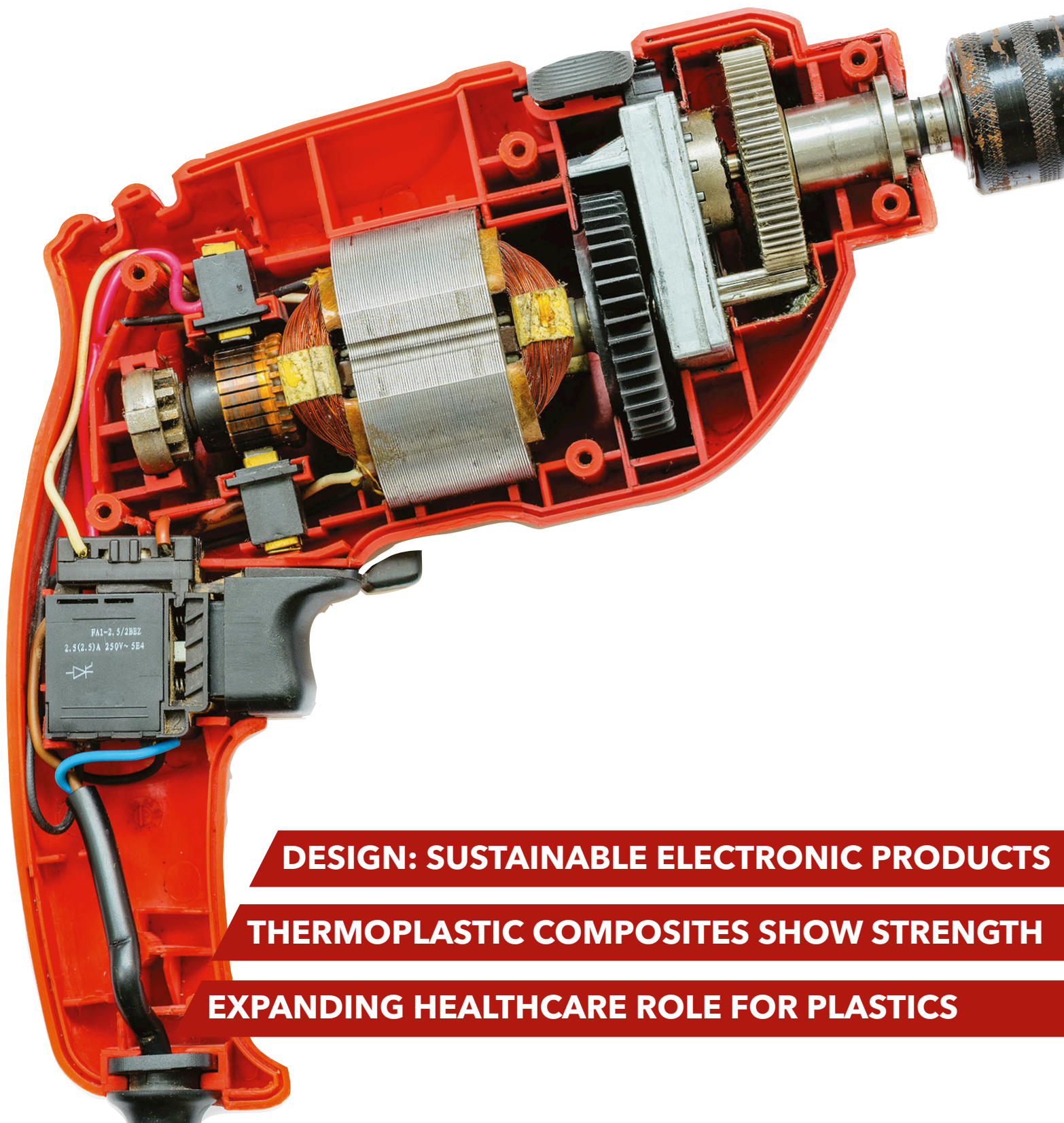


Injection WORLD



DESIGN: SUSTAINABLE ELECTRONIC PRODUCTS

THERMOPLASTIC COMPOSITES SHOW STRENGTH

EXPANDING HEALTHCARE ROLE FOR PLASTICS



Want to read **Injection** magazine offline? **WORLD**

Get the app and take your editions anywhere!

The *Injection World* magazine app is really easy to use and, once you've downloaded an edition, there's no need for a live data connection. It's great for anyone on the move. Just open the app to browse the latest edition on planes, trains, subways - anywhere.

The dedicated *Injection World* app is available free-of-charge for iPads, iPhones and a huge range of Android-based tablets and smartphones. Aside from enabling off-line reading, the app also gives you fast access to our archive of more than 35 back issues

allowing you to build up your own library. And if you opt for the free subscription on installation, all future editions will arrive on your device automatically.

The *Injection World* magazine app has already been downloaded more than 17,500 times by readers in more than 85 different countries. Why not try it out yourself. You can find the app in Apple's App Store, in iTunes and in the Google Play Store. Just search for "Injection World" or "AMI Plastics". Or click the relevant button below.



Download on the
App Store



GET IT ON
Google Play

Injection WORLD

4 News

News from the global plastics industry, including: Silgan to buy Albea's dispenser business, Mattel uses bio-PE in toy blocks, Chinaplas halted by coronavirus, US moulders react to 25% tariffs on Chinese moulds



PAGE 4

15 Designing sustainability into electronics

There are challenges ahead for technical injection moulders as electronic products and components start to be designed to be fit for the circular economy. By David Eldridge

PAGE 15



25 Composite moulding shows strength

Injection moulders are increasingly taking to new technology and materials enabling them to overmould thermoplastic composite parts. By Peter Mapleston



PAGE 25

33 Footwear brands get on sustainable track

We preview AMI's Polymers in Footwear conference in the US in April with insights from experts speaking at the event.

37 Expanding the healthcare role for plastics

Materials suitable for wearable devices and plastics with enhanced chemical resistance are just two of the trends driving the medical plastics materials market forward. By Mark Holmes

PAGE 37



PAGE 33



47 In touch with regulation

AMI's fourth Plastics Regulations Europe conference takes place in March, covering all from food contact to chemical regulation. We preview the event.

54 Diary

COMING NEXT ISSUE

➤ Thin Wall Moulding ➤ Materials Preparation ➤ Recycling Granulators

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

Editor: David Eldridge
david.eldridge@ami.international

Technology editor: Peter Mapleston
editorial@injectionworld.com

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

CLICK HERE TO MAKE SURE YOU GET YOUR COPY

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

DOWNLOAD MEDIA DATA

© Copyright Applied Market Information. No part may be reproduced without the prior written permission of the publisher.

Silgan to buy Albea's dispensing business

Closures manufacturer Silgan Holdings of the US has signed a binding offer to acquire Albea's dispensing business for \$900m.

The Albea business makes pumps, sprayers and foam dispensing systems for consumer goods in the beauty and personal care markets. It has ten plants in North America, Europe, South America and Asia, and had sales of about \$383m in 2018. The deal should close in the first half of 2020, subject to regulatory approval and closing conditions.

Silgan said that the acquisition would "expand its position in the dispensing markets to include highly engineered foam pumps, fine mist pumps, lotion pumps, samplers and fragrance caps, and closures for personal care and beauty products". It expects to achieve operational cost synergies of \$20m per year within 18 months.



The Albea business makes pumps and dispensers for lotions and other beauty products

"This would significantly enhance the scope and breadth of our market-leading closures franchise by bringing new products and capabilities in the highly engineered dispensing category, such as fine lotion dispensing solutions for skin care," said Tony Allott, Chairman and CEO. "The Albea dispensing business is a 'hand-in-glove' fit with our closures business."

Silgan has also acquired Cobra Plastics, which makes injection moulded closures for a wide variety of con-

sumer good applications, particularly aerosol overcaps. Cobra has annual sales of about \$30m and has two facilities in Macedonia, Ohio. Silgan President Adam Greenlee said: "The combination of Cobra's overcap product line with our aerosol actuators and dispensing systems will allow Silgan to offer a broader range of integrated solutions, including functional overcaps, to meet the unique needs of our customers."

> www.silganholdings.com

Comar buys iMark Molding

US packaging group Comar has acquired iMark Molding, which Comar said would support its growth objectives in the medical and pharmaceutical segments, adding further engineering and custom plastic moulding and assembly capabilities.

iMark is based at Woodville, Wisconsin, where it has an ISO13485-certified 12,000 m² facility with over 30 injection moulding machines and 1,400 m² of certified ISO Class 7 cleanroom space.

Company president Mark Sturtevant will continue to manage day-to-day operations. Comar, which is mainly owned by funds managed by Morgan Stanley Capital Partners, added that it does not plan any plant closures or employee layoffs.

> www.comar.com

ECHA consults on siloxane restrictions

The European Chemicals Agency (ECHA) said in December that its proposal to restrict the use of D4, D5 and D6 siloxanes, which are used in production of silicones and silicone rubbers, including LSR, has been supported by SEAC (Committee for Socio-Economic Analysis) and RAC (Committee for Risk Assessment).

The proposal is to restrict placing on the market D4, D5 and D6 siloxanes as substances, constituents of other substances, or in mixtures in a concen-

tration equal or greater than 0.1% w/w of each. A 60-day consultation was launched on 18 December 2019.

The proposed restriction has been described as "disproportionate" by Dr Pierre Germain, Secretary General of Cefic sector group Silicones Europe (CES), which represents the sector. He said the decision to characterise the substances based on persistence, bioaccumulative and toxic (PBT) under REACH "did not reflect the latest science."

Germain added that the restriction is aimed at products that directly reach consumer or professional end markets in the EU and that these would generally comply with the 0.1% limit. Industrial uses, he said, are covered by derogations that will allow manufacturers to produce D4, D5 and D6 siloxanes, formulate uncured polymers, and sell them to processors without restriction.

> www.echa.europa.eu

> www.silicones.eu

Winfactory 4.0

The supervision software
for the digital factory



- Management of storage, distribution and material utilization
- Efficiency of production and equipment uptime
- Raw material traceability
- Plant wide connectivity and integration with existing MRP systems



**New fully integrated
barcode reading system**

Step-by-step guide for the operator, for an easy and secure loading process of raw materials

Growing plastics shows return to Cleveland in US in 2020

Three free-to-attend exhibitions focused on compounding, plastics recycling and extrusion will return to the Huntington Convention Center in Cleveland, Ohio, US, on 4-5 November 2020, where they will be joined by a new expo focused on polymer testing and analysis.

The Compounding World Expo, Plastics Recycling World Expo and Plastics Extrusion World Expo, which are organised by *Injection World* publisher AMI, made highly successful US debuts in Cleveland in May 2019, attracting a total of 261 exhibitors and 4,375 visitors. The three expo events are set to grow in size for this year.

The Polymer Testing World Expo is a new focused exhibition and conference for scientists, laboratory staff and researchers who develop, test and analyse new polymer



Some of the 4,375 visitors to the 2019 show in Cleveland

materials, formulations and products. It will benefit from considerable crossover with the other exhibitions – 1,091 of the visitors to the other three expos in 2019 said they were involved in R&D and materials testing.

The exhibitions see the return of the five free conference theatres for 2020. These proved highly popular last year, attracting large crowds for their series

of technical papers, market forecasts, practical training seminars, and lively business debates.

"We were absolutely delighted with the response to our first US exhibitions, which were very well supported by the North American plastics extrusion, recycling and compounding industries," said AMI's Head of Exhibitions, Rita Andrews. "We've had extremely

positive feedback about the Cleveland shows from exhibitors and visitors alike."

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

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

Mattel using biobased plastics in toys

At the Nuremberg Toy Fair, Mattel announced the launch of products made from bio-based PE in three of the pre-school building sets in its Mega Bloks range: Polar Friends, Safari Friends and Woodland Friends. These will now be rolled out to retailers globally, the company said.

Mattel confirmed the PE it is using in these Mega Bloks items is supplied by Braskem. The group is also using it for Fisher Price Rock a Stack line.

Mattel says it has ongoing trials with bio-based and recycled polymers. It currently uses mostly PE and ABS for bricks. Mattel has a goal to achieve 100% recycled, recyclable or biobased plastics in its products and packaging by 2030.

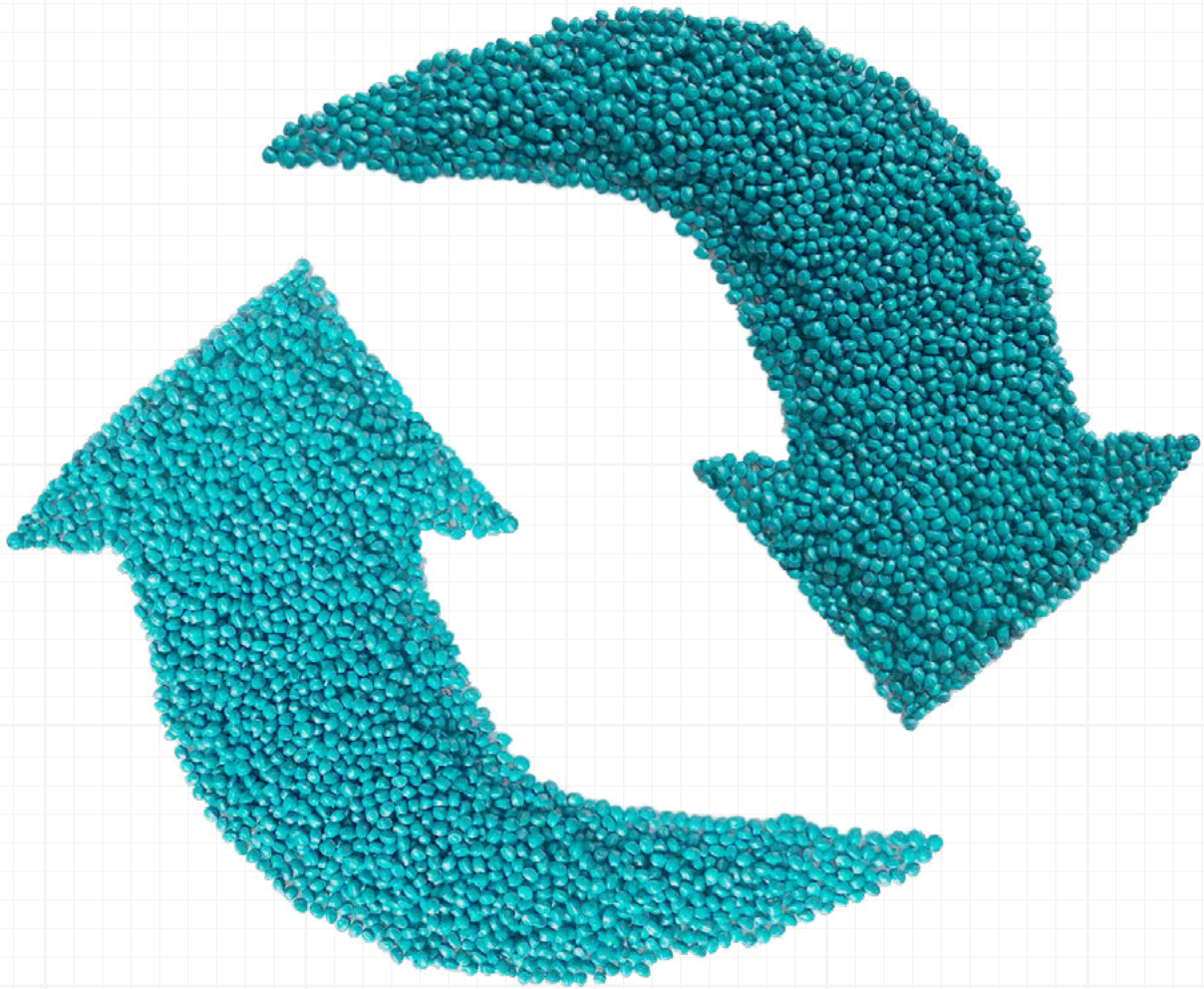
➤ www.megabloks.com

A Mega Bloks range made using bio-based PE



Dryflex® Circular

TPEs with Recycled Content



BE CURIOUS →

HEXPOL TPE

circular@hexpolTPE.com

www.hexpolTPE.com



Coronavirus causes delays to Chinaplas and Asiamold

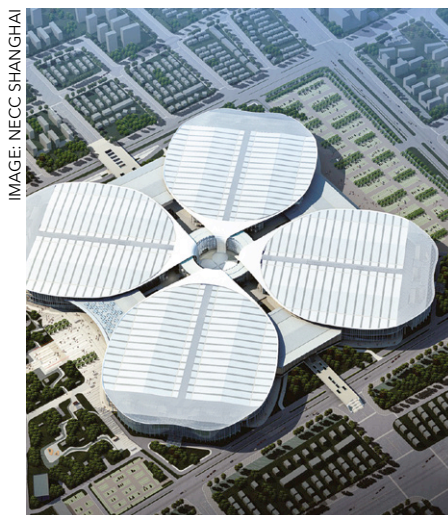
The coronavirus outbreak which started in China and has led to business disruption throughout Southeast Asia has forced organisers of major plastics exhibitions to postpone the events.

Organisers of the Chinaplas 2020 plastics trade fair, which was due to take place in Shanghai on 21-24 April, have announced its postponement due to coronavirus health restrictions.

In a statement published on 5 February, show organiser Adsale said: "We sincerely apologise for any inconvenience caused due to the show postponement. Health and safety of all show participants are at our top priority, therefore we have to make this decision."

Adsale said it was closely monitoring the coronavirus situation and would announce new dates in the future.

The annual Chinaplas show is one of the world's biggest plastics exhibitions and has traditionally alternated



Chinaplas 2020 will not take place on 21-24 April in Shanghai as planned

between Shanghai and Guangzhou. The previous event in Shanghai in 2018 attracted 180,000 visitors.

Adsale said in January it would relocate the Guangzhou show to Shenzhen in 2021 to cope with

growing visitor numbers. Dates have been set for 13-16 April 2021, which puts it three weeks ahead of Italy's Plast exhibition and five ahead of the US NPE show.

The coronavirus outbreak also forced organisers of the Asiamold fair to announce a postponement. The exhibition for mould-making, additive manufacturing and forming technologies had been due to take place on 26-28 February at China Import and Export Fair Complex, Guangzhou. The organisers said new dates for the fairs will be announced in due course.

Asiamold is organised by the Chinese arm of Messe Frankfurt and is supported by the Formnext event held in Frankfurt. In 2019, Asiamold and the co-located Industrial Automation Fair Guangzhou (SIAF) had 988 exhibitors and attracted 98,000 visitors.

➤ www.chinaplasonline.com

➤ www.messefrankfurt.com

New Arburg tech MD

Guido Frohnhaus has taken over as Managing Director of technology and engineering at Arburg in Lossburg, Germany.

His remit includes the production, R&D, materials administration and technical administration departments.

Frohnhaus formerly was VP of technology at the US subsidiary of the Turck Group and MD of Werner Turck in Halver.

➤ www.arburg.com

SGL Carbon wins contracts in e-car battery market

Wiesbaden, Germany-based composites group SGL Carbon has received a "substantial contract" from a North American automaker for high-volume serial production of carbon and glass fibre-based composite top and bottom layers for battery enclosures.

Serial production of the components for the North America customer will start at the end of 2020. The carbon fibres, fabrics and assembled components will all come from the company's fully integrated value

chain. There is also potential for further large volumes for the customer's shared platform, SGL said.

Another new contract for SGL in Europe from a sports car manufacturer is for serial production of composite bottom layers from mid-2020. SGL added that it is in talks with other automotive manufacturers to develop and manufacture battery enclosures for their e-car platforms.

SGL has also opened a 2,000 m² production hall for graphite-based automotive

components at its plant in Bonn, Germany. The project involved installing partly new production facilities and a modernised production set-up. In all, the company has spent about €25m to expand the site.

The investment was driven by increasing demand for graphite in the automotive sector.

The material is used in rotors and vanes in vacuum pumps for brake boosters and bearings for exhaust gas management.

➤ www.sglcarbon.com



Showing our colours – closing material cycles

At ENGEL, we embrace responsibility, helping our customers achieve sustainable injection moulding production. At the heart of this are our inject 4.0 solutions for the smart factory, which also open up new opportunities for the Circular Economy. For instance, the iQ weight control software balances out process fluctuations when processing recycled material. Consistent high part quality increases the range of possible uses for the recycled material.

Technologically, we are also promoting increased use of recycled material. With the new ENGEL skinmelt process, we are enabling a high proportion of recycled material even in complex component geometries.

The bottom line: green is more than the colour of our machines. Check out our inject 4.0 smart solutions and contact us today.



ENGEL
be the first

engelglobal.com/circular-economy

US moulders react to 25% tariffs reimposed on Chinese moulds

The decision by the US government to reinstate 25% tariffs on injection moulds imported from China has triggered responses from US moulding groups. The Office of the US Trade Representative announced on 23 December 2019 that it would not extend a temporary exclusion that had been in place since December 2018 for the 25% tariffs imposed in July 2018.

The American Mold Builders Association (AMBA) applauded the reimposition. "This is an important victory for AMBA, its members and

all small downstream manufacturers who have felt the pressure from China for years," said Kym Conis, Managing Director of the AMBA.

Injection mould buyers were not so welcoming of the development. Many US injection moulding companies have sourced moulds from Chinese suppliers in recent years for cost and technical reasons. Moulders contacted by *Injection World* said the US decision has led to various knock-on effects in the mould market.

"Domestic mould building

has not increased significantly yet, as customers who want a lower-cost mould are simply sourcing from other countries," said Jim Sensenbrenner, Corporate Tooling Manager at EVCO Plastics in DeForest, Wisconsin. "The moulds we would typically contract overseas in China are now moving to places like Taiwan."

EVCO has a mould manufacturing facility in Dongguan, China, where it builds moulds to US standards for use at any of the group's global injection moulding facilities. Sensen-

brenner indicated the Dongguan facility would not be greatly affected by the US tariffs as it is building more moulds for production runs in China or Mexico, rather than the US.

Dale Evans, CEO at EVCO, said: "All of the volatility relating to these tariffs has made sourcing moulds into a chess game. We move the pieces around the board as best as we can. The US, China, Taiwan, Mexico and Canada are all in play."

Berry Global, another major US injection moulder contacted by *Injection*

NEW REPORT

RIGID POLYOLEFIN RECYCLING IN EUROPE

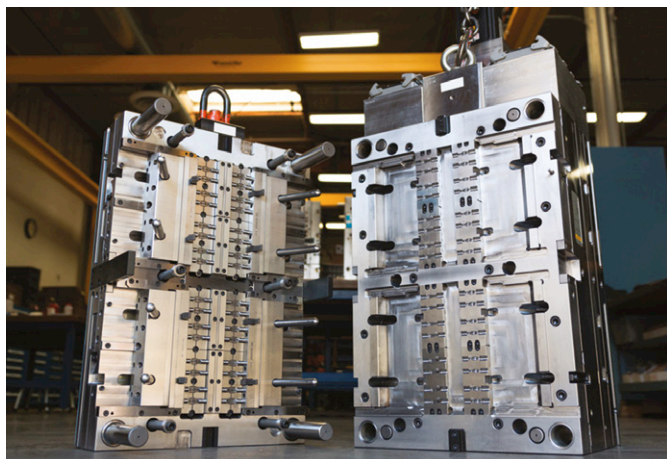
Capacity, Technology
and Recyclate Usage

FIND
OUT
MORE



Be market
ready with
the latest
legislation,
technology
and recyclate
usage data
for Europe

IMAGE: SHUTTERSTOCK



World, also has mould making capacity. The recent acquisition of RPC Group in Europe has added to its internal capabilities. Kevin Mesker, Tooling Director, said this helps the group balance its needs.

He said: "Our [mould] selection process includes receiving bids from both

internal and external suppliers to ensure we get the highest quality and most reliable moulds at a competitive price. Although tariffs are now something which require our attention and must be factored into the bidding process, our mould vendor selection process will continue to be based on

Left: In December, the US government reinstated 25% tariffs on injection moulds imported from China

getting the highest quality moulds that can best serve our customers."

US-based injection moulders made submissions to the Office of USTR ahead of its decision, stressing the need to keep the cost of moulds down. Some highlighted the need for speed, when their customers try to capitalise on a market opportunity. Such short lead times may be better dealt with by an overseas mould supplier, they say, especially at times when US capacity for building moulds is tight.

Specialised mould making requirements also

lead US moulders to work with overseas partners if they cannot find a US mould builder with the right capabilities. This may be in demanding moulding markets such as medical products, electronics and automotive.

AMBA says the US mould building industry has the capacity and expertise to fill any orders placed. Kym Conis said in the ABMA's announcement: "With over 1,400 mould builders in this country and nearly \$500m in open capacity, America's mould builders, with the tariffs back in place, now can compete on more equal footing."

➤ <https://amba.org>

➤ www.evcoplastics.com

➤ www.berryglobal.com

More than 50 years of...

CUSTOMER SERVICE

BECAUSE WE CAN

polykemi 

BRINGS OUT THE BEST IN PLASTICS

FOLLOW US AT



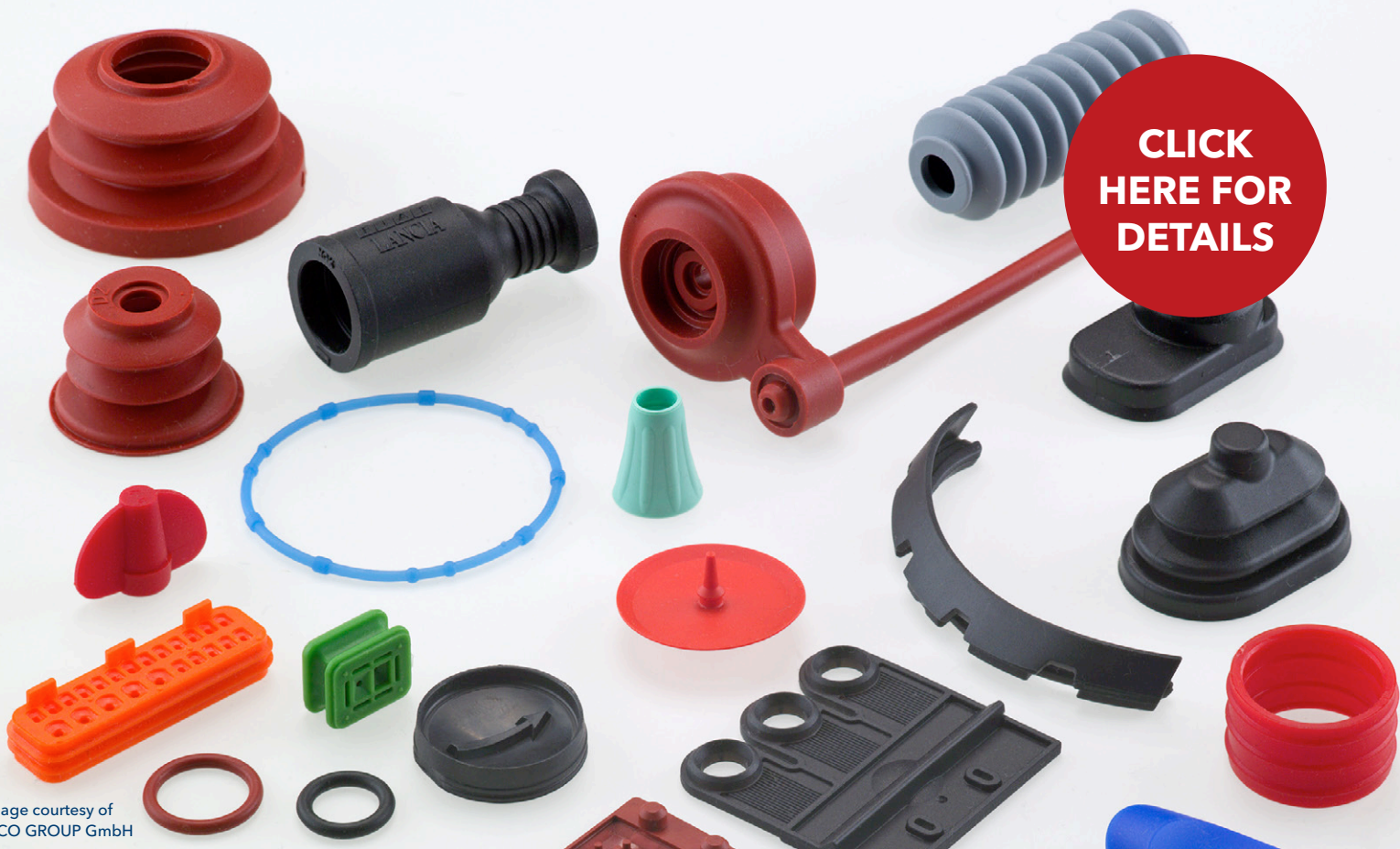
LSR Innovations

Düsseldorf / 2020

Exploring the fast-developing market for LSR components

4 - 5 March 2020

Crowne Plaza, Düsseldorf - Neuss, Germany



Media supporter:

**Injection
WORLD**

Poor year for Italian machinery

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

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

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

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

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

"I note a certain amount of concern deriving from the less than encouraging prospects for both the domestic and foreign markets," said Amaplast president Dario Previero. "However, we must not overlook the fact that this slump - whose first signs were seen in the year-end results for 2018 - comes after a long period of growth. With the sole exception of 2013, we have witnessed seven years with a plus sign."

Germany remains the top export market, though sales there were 19.9% down at €270m and its share of the

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

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

➤ www.amaplast.org

INglass sells moulds unit

INglass of San Polo di Piave, Italy has sold its moulds division to Luigi Cover, owner of CST Stampi and Roberto Fagarazzi, who had been sales director of the moulds division since 2015. Now renamed Inevo, this business focuses on moulds for automotive lighting market and glazing technology.

INglass itself will now concentrate entirely on its HRSflow hot runner business. President and founder Maurizio Bazzo said that this is "a market that requires continuous innovation and investments in order to satisfy the increasingly demanding needs of the injection moulding industry".

In a separate announcement, US injection moulding consultancy RJG said it has partnered with HRSflow on a project. The two companies



INglass subsidiary HRSflow has worked on a project with RJG, the US injection moulding consultancy

have run trials with a mould cavity sensor-based system to respond to production fluctuations during operation of HRSflow's sequential valve gate FLEXflow hot runner system.

In addition, they tested temperature sensors, which communicate with the

FLEXflow hot runner system via the RJG eDART process control and monitoring system. RJG said results from the trials showed benefits in cost savings, lower scrap and increased quality and yield.

➤ www.inglass.it

➤ <https://rjginc.com>

Jarden's new name

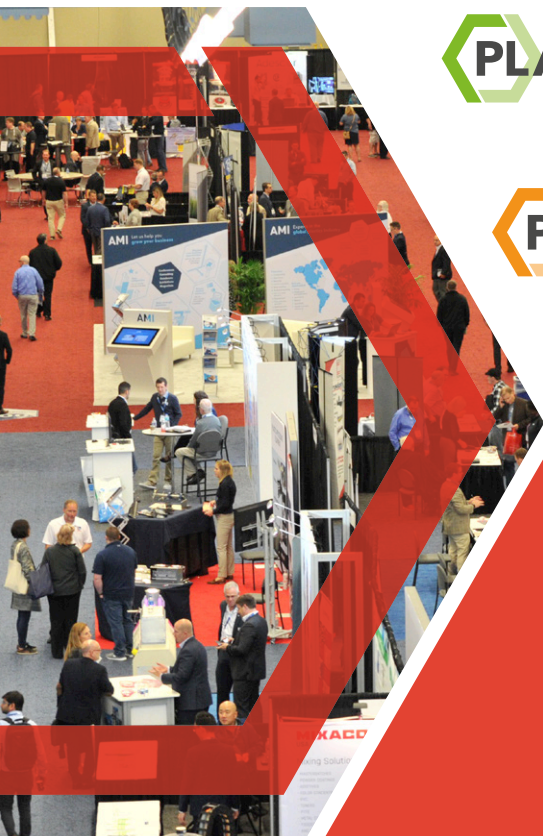
Jarden Process Solutions, the producer of rigid packaging for medical, consumer and industrial markets, with 19 facilities in US, UK and Puerto Rico, has rebranded to Jadex.

Jarden's sub-brands are also rebranding, with Jarden Plastic Solutions becoming Alltrista Plastics, while Jarden Applied Materials is now Shakespeare Company.

Jarden Zinc Products has become Artazn and Lifoam Industries has become LifeMade Products.

As part of their new identities, each company will focus on future sustainability, innovation and technology said Jarden.

➤ www.jadexinc.com



PLASTICS RECYCLING
WORLD EXPO

POLYMER TESTING
WORLD EXPO

PLASTICS EXTRUSION
WORLD EXPO

COMPOUNDING
WORLD EXPO

Register for free

3 - 4 June 2020

MESSE ESSEN, GERMANY

Co-located exhibition for the entire plastics industry

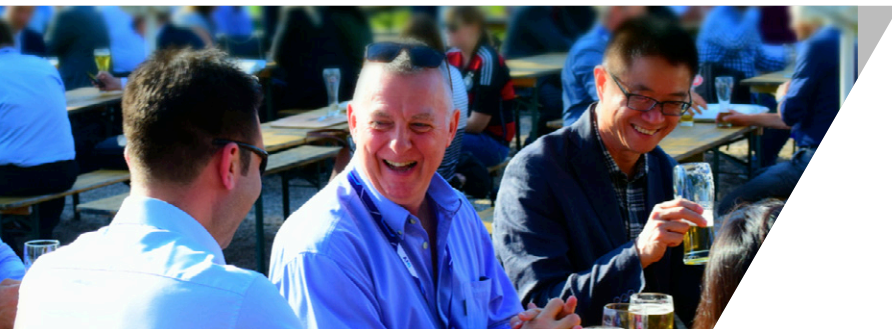
300+ EXHIBITORS

100+ SPEAKERS

5 CONFERENCE THEATRES

1 FREE TICKET

across the 4 expos



NETWORKING PARTY 3 JUNE 2020

Get together with customers
and suppliers on 3 June

**CLICK HERE
FIND OUT MORE**

ami.international/exhibitions

**GUARANTEE YOUR
FREE TICKET**

[click here for more information](#)

Brought to you by:

AMI

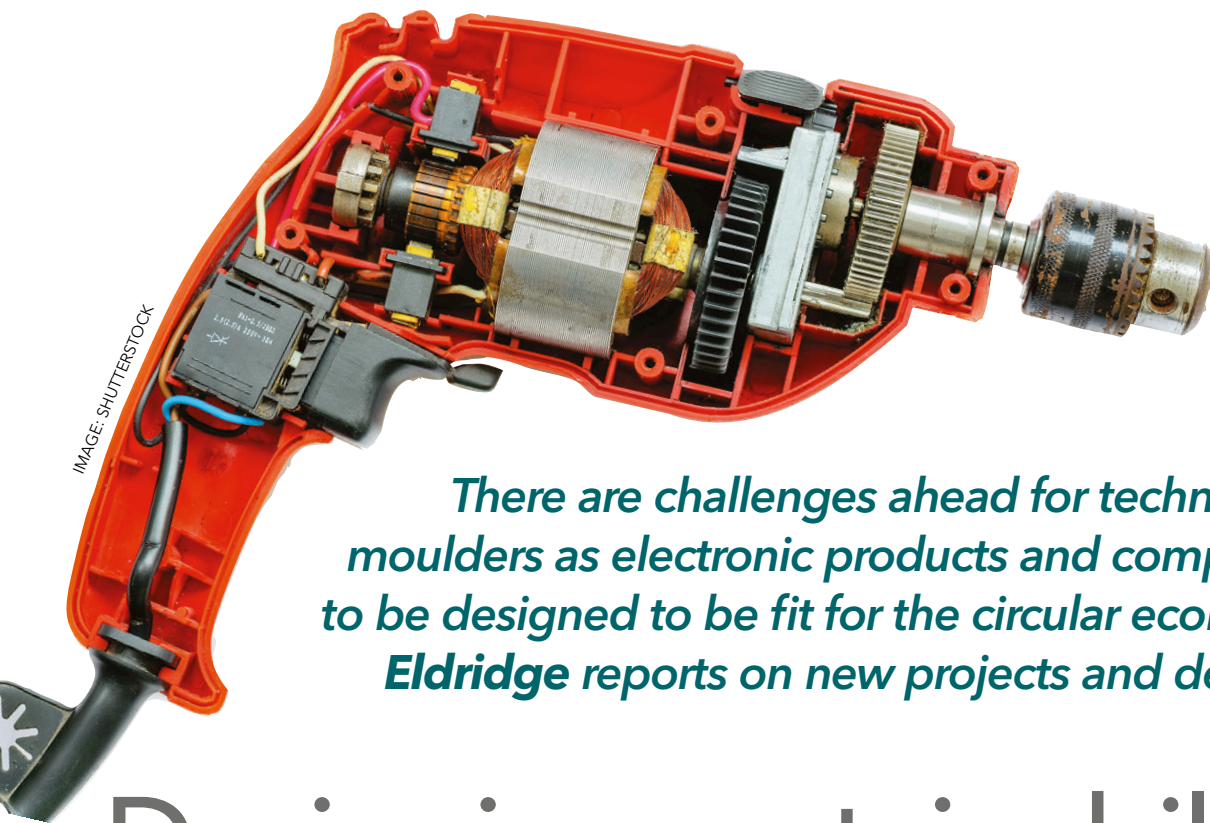
Proudly supported by:

Compounding
WORLD

Film and Sheet
EXTRUSION

Pipe and Profile
EXTRUSION

Plastics Recycling
WORLD



There are challenges ahead for technical injection moulders as electronic products and components start to be designed to be fit for the circular economy. David Eldridge reports on new projects and developments

Designing sustainability into electronic products

The sustainability agenda requires that plastics products not only become easier to recycle, but also incorporate more plastics recycle. The recycling drive is not just about packaging, as many injection moulders of technical parts are being increasingly asked by customers to address the recyclability and recycled content of moulded products. But what happens when the products in question are the demanding moulding applications of the electronics industry? Putting the customer's recycling request into practice raises issues in design, materials, processing and the supply chain for injection moulders. Some of these issues were discussed at AMI's Plastic: Design for Sustainability conference in Berlin in December 2019.

In the **PolyCE** project, design for recycling guidelines are being developed for electronic products, but the use of recyclate in new electronics products is also a focus of the project. Both development areas were discussed by project participants at the AMI conference. Gergana Dimitrova, Researcher and Project Manager at **Fraunhofer IZM** in Germany, said recyclers and product designers have not communicated their respective needs to each other in the past. The PolyCe project is developing two approaches to bridge this gap: "Gate A" concerns what a designer needs from materials recyclers in order to make

new products using recyclate; "Gate B" is about designing products to be recyclable. For the second approach, Fraunhofer IZM and Austrian recycler MGG Polymers are developing design for recycling guidelines. These are expected to be finished by the end of 2021, but Dimitrova shared some of the key guidelines in her presentation.

The first guideline from the PolyCE project for designing new electronic products for recyclability is: keep the moulded product parts as big as possible, as small parts end up in the fines fraction at a recycling facility and so are not recycled. If possible, avoid moulding plastics around metal parts and avoid two-component moulding, as both types end up in a recycler's heavy fraction and often are incinerated. It is advisable to use limited polymer types that are readily recycled; so in electronic products that means sticking with PC, PC/ABS, ABS, HIPS, PA and PP. Avoid PVC, due to the potential for hydrochloric acid to form as a degradation product; and if POM is being used, use only unblended POM, to avoid formaldehyde as a degradation product.

Dimitrova's co-presenter on the PolyCE project was Thijs Feenstra, Product Developer and Project Lead at **Pezy Group**, a design and innovation company with 100+ staff at different locations in Netherlands. He said that about 10 years ago, Pezy

Main image:
There are demanding electronics applications for injection moulding

Right: Pezy designed an electronic product for Wireless Value using both design-for-recycling and design-from-recycling principles

recognised the responsibility that comes from designing consumer products that use a large amount of plastics. "This responsibility made us feel we needed to embrace a sustainable way of working," he said, which led Pezy to consult Michael Braungart, one of the founders of the Cradle-to-Cradle Design approach.

"Design for recycling is very important," said Feenstra. "But I think it may be even more important to implement design *from* recycling. If you do those two, then you really have the proof in hand, that this product is really circular."

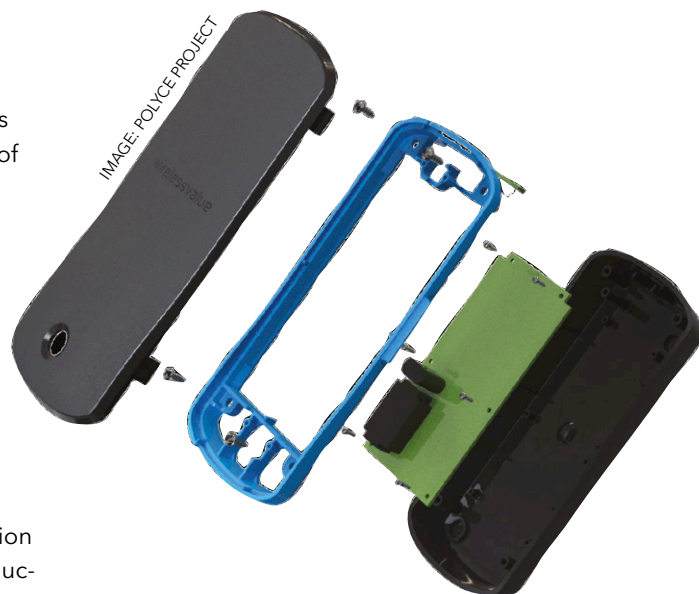
There are four elements a designer has to consider in a new product which is to be injection moulded: material, geometry, mould and production process. He said: "If you do these four right and they are in balance with each other, then in the end you have a good product. This is the way we work. We call it the 'design waterfall'."

In these four aspects, Pezy has seen a lot of problems arising when implementing PCR plastics during the 10 years of experience the company has in designing products using recyclate. The materials aspect has caused particular difficulties. Using the example of selecting a PP material, Feenstra said a producer of virgin PP gives technical guidance during product design and development stages. Not only does the producer have a good portfolio of PP materials, it also thinks about the specific application and which material is needed to achieve a certain performance.

When it comes to PCR, these materials need to be sourced from new suppliers, recycling companies which need to be found first. "You have to build the supply network again," he said. Often these companies lack know-how about materials and applications.

Common problems of using a PCR material include its odour, possible ash content and contamination, and the difficulties presented by colour quality. But, said Feenstra, "Melt flow index is actually getting better -- so we also see positive things as well."

In the aspect of geometry, the designer is provided with a specification for the whole product, but not for individual parts. So the upper and lower limits of mechanical properties of the part are unknown; CP/CPk values are uncertain; and there is no mould filling simulation data. PCR may present difficulties with the mould, such as surface contamination due to outgassing and blocked hot runner systems. In production, PCR usually presents processing



variations, undermining process stability.

Feenstra advises taking "baby steps" when using a PCR material. Try the material on a simple product first, not a multi-part product like a vacuum cleaner. "Get acquainted with the material" and see how it behaves during production and its aesthetic result, he said.

As part of the PolyCE project, Pezy designed an electronic product using both design-for-recycling and design-from-recycling principles. The new product, which measures data in an office environment (temperature, moisture, light etc), was designed for Wireless Value in the Netherlands.

"We tried to see how far we could get," said Feenstra. "What we learned - not only from this product but also from a Philips Senseo coffee machine - is that you can get very far, if you use your skills as a designer in the right way."

The product looks and behaves exactly the same as if made with virgin plastics, he said. "It's a design that is attractive, that fits the market and makes use of PCR." The black housing parts are PCR ABS, while the centre ring part, produced in a range of different colours, is PIR ABS to allow freedom of colour selection.

It was also designed with design-for-recycling features: it is made with one common and easily recyclable plastic, ABS; it takes shredding into consideration by using only screws (not glue) and has no different materials moulded together or materials permanently enclosed; it has no coatings and the brand logo is moulded (not a label); the battery is easy to remove; and its modularity allows different product categories (by way of the colour centre ring) and is design-ready for updates.

Professor Kim Ragaert, from the faculty of engineering and architecture at **Ghent University**, also discussed her work in the PolyCE project as

Below: A Philips shaver was designed in the PolyCe project





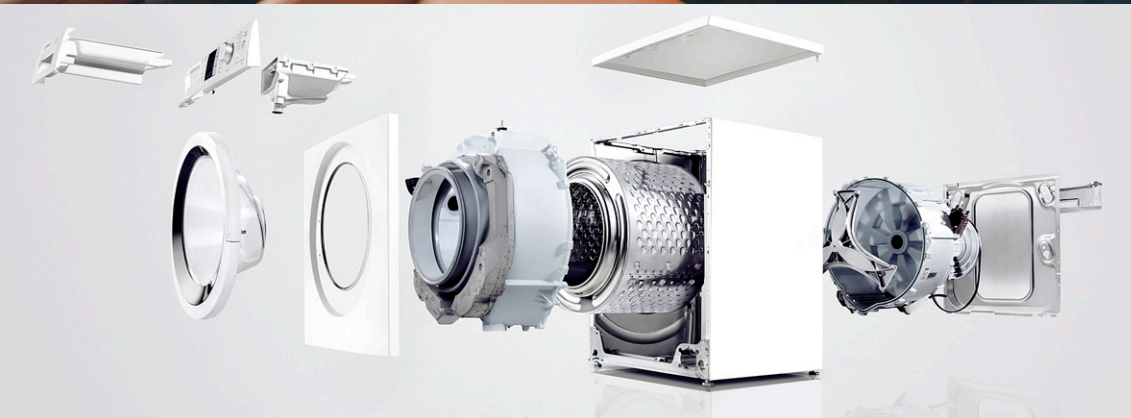
Performance Polypropylene

SAVE €200*

when you
book before
28 February 2020

Developing new formulations and applications for
high-performance polypropylene compounds

29-30 April 2020, Pullman Cologne, Cologne, Germany



Media supporters:

Compounding
WORLD

Injection
WORLD

Plastics Recycling
WORLD

*Discount cannot be retrospectively applied or used in conjunction with any other offer

NEW DATABASE

PLASTICS PROCESSORS IN AFRICA

**Get instant access to over
1,000 processing sites**

Explore new sales opportunities in this
vast continent with verified contact
and production data

T/ +44 (0) 117 314 8114 E/ Sales@ami.international

FIND OUT MORE

AMI

Robust research and expert data for the global plastics industry



one of the topics in her presentation at the AMI conference. She referred to a **Philips** shaver that is due to go into commercial production during 2020. The shaver is moulded in PC-ABS PCR material and incorporates a light diffuser also made from recycled material.

Philips has been at the forefront of the trend to use recycle in new products, including in vacuum cleaners and coffee machines. It first started its work on adopting recycled plastics in new products back in 2010. The amount of recycled plastics the group uses each year has risen steadily and reached 1,800 tonnes in 2017 and 2,200 tonnes in 2018. It has a target to boost that figure to 7,600 tonnes by 2025, said Eelco Smit, Senior Director Sustainability at Philips, in a presentation at AMI's 2018 Design for Sustainability conference in London (see *Plastics Recycling World* March-April 2019 issue).

Philips announced in January that it was splitting out its Domestic Appliances business and reviewing its ownership options, in order for the group to focus closely on its medical and healthcare products business. But there is strong momentum in the sustainability programmes it has started in the electronics business for them to be carried

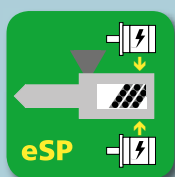


IMAGE: COVESTRO

forward. For example, it is a founding member of the global Platform for Accelerating the Circular Economy. One of the PACE projects is to create a platform for high level collaboration on building a circular economy for electronics on a global scale.

The design perspective of a materials group was provided at AMI's 2019 conference in Berlin by Niklas Meine, Marketing Segment Manager for the polycarbonates business at **Covestro**. He highlighted work done by the group on product design concepts for smart homes which it developed with

Above: At K2019, Covestro showed product design concepts for smart homes which it developed with Design Affairs



E - Drive

BOY®

Spritzgiessautomaten

**Electro-
mechanically
driven
injection unit**

All movements of the injection moulding process, such as ejector, core pull and mould, as well as electromechanical dosing and injection, are performed simultaneously with high precision via independent servo-motor drive axes.

The electromechanical drive of the injection unit - separated from the machine hydraulics - offers advantages in case of short cycle times and high dosages.

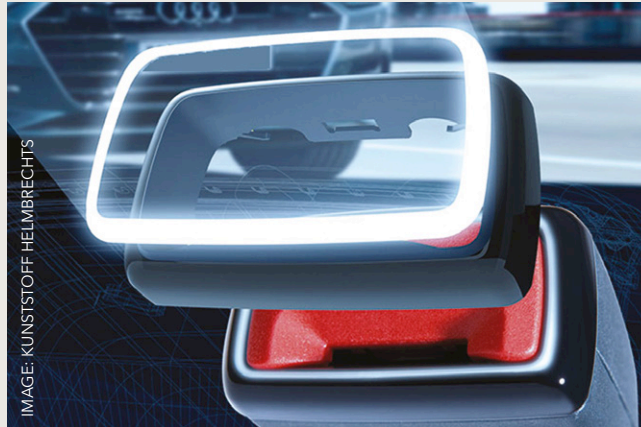
Now Hybrid

TecPart 2019 Awards highlight moulding innovation and sustainability

The 2019 Innovation Awards from the GKV and **TecPart** associations in Germany were announced – as is the tradition – on the first day of the K Show in October. The prizes reward technical achievements by plastics processors, and recent innovations by injection moulders often feature prominently in the awards.

Michael Weigelt, Managing Director of GKV/TecPart, commented on the sustainability benefits of plastics that are showcased by the award winners. He said: "Products and entire assemblies made of conventional materials are constantly being replaced by resource-saving solutions made of polymer materials."

Automotive supplier **Kunststoff**



The Audi A7's illuminated belt buckle won an award for Kunststoff Helmbrechts

Helmbrechts (KH) was a major winner, receiving three TecPart 2019 awards. The awards were for a sophisticated tooling solution for the production of the illuminated belt buckle in the Audi A7, the vanishing effect of a 3D white panel, and a chrome finish painting

with coating thickness of just 1 µm.

KH said: "The challenge presented by the belt buckle was that the PC optical fibre had to be surrounded by an inner and outer frame of PC-ABS without any shadow being created by the connectors. The KH tool-making team developed a twin-turn tool in which the moveable and the (usually) fixed side

turn, and a hot-runner system which is self-guided by means of individual plates and the rotary axis."

The companies given TecPart 2019 awards were: Etimex Technical Components, Helvoet Rubber & Plastic Technologies, Klaus Kunststofftechnik, Koki Technik Transmission Systems, KH, LAKOWA, LKH Kunststoffwerk Heiligenroth, Odelo and ROS.

German consultancy **Design Affairs** and which it showed at K2019. One of these designs is for a portable air treatment device which is part of a modular and multi-functional appliance system. Covestro says: "The high level of standardisation and modularisation of the system allows the potential use of recycled materials, and the product's components can be easily adjusted, upgraded or refurbished based on the user's needs to expand the product's life-span." For the prototype shown at K2019 the company used a flame-retardant Bayblend PC/ABS grade for safety and versatility.

At the AMI conference, Meine said Covestro has been working with electronics customers in Asia on the use of recycled PC materials in new devices. "The task was using recycled materials to make a cover for notebooks. We started from water bottles which, in principle, are made from quite pure polycarbonate. They are used for many years, then shredded and we develop different grades for the electronics industry."

The big challenge, he said, is getting the right waste streams suited to the demands of electronic applications. Waste streams are sourced in cities

and include water cooler bottles, car headlamps and PC sheet. It is important to source transparent PC materials, he said, as these are not only easy to colour but are also better for quality reasons, as compounds in coloured PC can affect quality during reprocessing.

Meine said electronics companies demand materials that have a good surface quality and meet flammability standards. Covestro's answer is to blend recycled PC with virgin material. Passing a sample notebook cover round the conference audience, he said "the notebook cover contains 35% recyclate, and with 65% virgin material the quality is controlled".

CLICK ON THE LINKS FOR MORE INFORMATION:

- > www.polyce-project.eu
- > www.izm.fraunhofer.de
- > <https://pezygroup.com>
- > www.ugent.be/ea
- > www.philips.com
- > www.covestro.com
- > www.designaffairs.com
- > www.tecpart.de
- > www.kh.de

Single-Serve Capsules

Austin / 2020

*Identifying opportunities and overcoming obstacles
in the single-serve capsules industry*

March 3-4, 2020

Sheraton Austin Georgetown Hotel, TX, United States



Headline Sponsor



Otto Hofstetter

Also sponsored by:



Media supporters:



**Injection Film and Sheet
WORLD EXTRUSION**



Bringing the plastics industry together.



@Contact_AMI #AMICapsulesUS

PLASTICS EXTRUSION
WORLD EXPO

POLYMER TESTING
WORLD EXPO

3 - 4 June 2020

PLASTICS RECYCLING
WORLD EXPO

COMPOUNDING
WORLD EXPO

MESSE ESSEN
GERMANY

More than 300 companies have already booked their stands including:

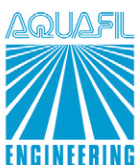


FARREL POMINI
continuous compounding systems



coperion
confidence through partnership

Starlinger



Brought to you by:



Proudly supported by:

Compounding
WORLD

Film and Sheet
EXTRUSION

Pipe and Profile
EXTRUSION

Plastics Recycling
WORLD

Book your stand

GET
YOUR
FREE
TICKET

To book your stand, contact:
exhibition_sales@ami.international / +44 (0) 117 924 9442



CLARIANT

IMERYS

BRENNTAG

NGR
PLASTIC RECYCLING TECHNOLOGIES

kaneka

Reifenhäuser
EXTRUSION SYSTEMS

KISUMA

THEYSOHN
Extrusion

Brabender



C.A.PICARD
INTERNATIONAL

MAGNESIA
GERMANY

WITEC
PUMPS & TECHNOLOGY

JSW
THE JAPAN STEEL WORKS, LTD.

SCIENCES
COMPUTERS
CONSULTANTS

OUR PEOPLE MAKE THE DIFFERENCE
J-TEC MATERIAL HANDLING

Leistritz

EVONIK
POWER TO CREATE

PiovanGroup

SIKORA
Technology To Perfection

KENNAMETAL
CONFORMA CLAD

X-COMPOUND
Plastic compounding plants

IMCD

POLYSCOPE
fresh thinking, great products

nanocyl

PLASTIC
SYSTEMS

WACKER

ALTECH

Grolman
International Distribution

Polycompound AG

schenckprocess



FILTEC
Plastic Pelletizing Precision

EPS
RECYCLE

ZIEGLER
MINERALS

LAB TECH
ENGINEERING COMPANY LTD

MONTELO
Recovery and Recycling Industry
Plastic - Fertilizers - Energy - Biomethane

vinylrecycling.com
challenge us with your pvc scrap

MARIS

ELIX
POLYMERS

Trendelkamp

BEIER
贝尔机械

motan
colortronic

extruder
experts

FIMIC
ITALIAN MELT FILTER

SCHWING
TECHNOLOGIES

get
recycling
Plastic Recycling Solutions

KRONES

POLYSTAR

binova
COMPOUNDING & RECYCLING

KMI
INDUSTRIAL MINERALS

Unipetrol
OLEN GROUP

UNIBROM
CORP

Bronkhorst
Flow Technology

euroceras

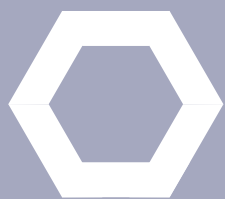
plasmecc
Excellence in Mixing

AZO

and many more...

www.ami.international/exhibitions





Performance Polyamides

May 5-6 2020

The Dearborn Inn, Marriott Hotel,
Dearborn, Detroit, United States

Trends and technical developments
in the polyamides industry

REGISTER TODAY



Join the discussion at the Performance Polyamides Conference

Performance Polyamides 2020 is relevant for the entire polyamide supply chain including producers, compounders, injection molders, product designers, materials specifiers and end-users. In addition to the content-led program, an exhibition runs alongside the event, providing plenty of networking opportunities during the refreshment breaks, lunches and evening reception.

- Learn about the latest technologies to boost the performance of polyamides
- Benefit from unique insight from polyamide experts and major manufacturers
- Connect with key players from throughout the polyamide supply chain
- Explore emerging opportunities in exciting new applications and markets
- Hear from leading compounders about tailoring the properties of polyamides

Sponsored by:

ALBIS

Media supporters:

**Compounding
WORLD**

**Injection
WORLD**



Injection moulders are increasingly taking to new technology and materials enabling them to overmould thermoplastic composite parts. Peter Mapleston investigates the products offered by major suppliers

Thermoplastic composite moulding shows strength

Technologies for producing thermoplastic composites by injection moulding over inserts of continuous fibre reinforcements are moving quickly into commercial use. Applications are opening up across multiple market sectors, but it is clear that the main attraction is automotive and other transport forms that benefit most from the ability of the technology to deliver, cost-effectively, at high production rates, parts that are light and strong.

Engel's organomelt process is typical of the breed. Fibre-reinforced prepreg sheet or tape with a thermoplastic matrix is heated, inserted into the mould, formed there and directly over-moulded with thermoplastic. It has already been used in high-volume manufacturing, including fully automated production of items such as front-end carriers. But it continues to develop in sophistication and applicability.

Norbert Müller, head of Engel's Centre for Lightweight Composite Technologies, says thermoplastic composites are growing in importance when it comes to lightweighting in the automotive industry, for two main reasons. Firstly, the consistent thermoplastic approach makes it possible to efficiently integrate the forming and functionalisation of fibre-reinforced prepreps, which reduces unit costs. Secondly, the use of exclusively thermoplastic polymers makes it easier to develop recycling strategies. "Returning composite components

to the material loop at the end of their service life is one of the priorities for ongoing development in the electric vehicle sector," Müller says.

Engel says it is working together with its customers and partners on the production aspects of designing composite components with a targeted load distribution. "In the future, several different prepreps will be combined for each component to tailor the lightweight construction characteristics to the relevant component's shape as well as the different stresses on individual areas inside the component," Müller says.

At K 2019, Engel showed how organomelt can produce parts that reflect the latest innovations for car door modules. The production cell on its stand was the first in the world to use infrared radiation to heat up and form three organic sheets of differing thicknesses, as well as shaping a high-quality visible surface in the same injection moulding process stage.

The process was developed in partnership with automotive supplier **Brose**. At the time, Engel said this was the only system in the world that can simultaneously process three differently shaped organic sheets between 0.6 mm and 2.5 mm in thickness in a fully automated process involving integrated IR ovens.

A vertical IR oven directly above the clamping unit heated up one organic sheet, just 0.6 mm thick.

Main image:
Ineos Styrolution's StyLight Aesthetic S C200-1 has high fibre density and improved stiffness.
(Photo: Ineos Styrolution)

Demonstration part made by Engel at K 2019. The organic sheets, produced by Chinese materials company Kingfa, are made of glass fibre reinforced polypropylene. The mould, built by Georg Kaufmann Formenbau, formed the sheets when it closed. Immediately afterwards, they were over-moulded with glass fibre-reinforced PP. Reinforcing ribs were shaped on the back of the component, while the front surface was given a leather-look grain

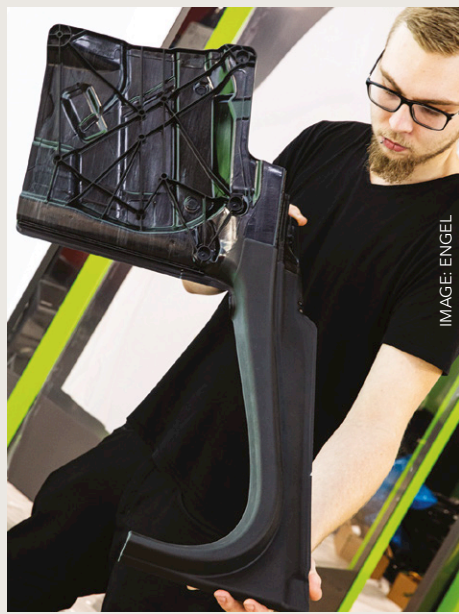


IMAGE: ENGEL

The positioning of the oven ensured the sheet had virtually no time to cool down and become impossible to form. A horizontal IR oven on a pedestal above the moving platen was used for two thicker sheets (1 mm and 2.5 mm). The ovens (made by Engel) and the three Easix robots were fully integrated with the injection machine's control unit.

Brose, which has been producing more than one million door module carriers a year since 2018, is not putting all its eggs in one basket. To date, those modules have been made with **Krauss Maffei** Fiberform Technology.

Also in on the act is **Arburg**. Last September, it said that it and **Dieffenbacher**, which specialises in very large vertical presses, will cooperate to develop

new solutions for the transfer moulding of hybrid components. The two companies recently demonstrated their cooperation as part of the German government-funded MoPaHyb research project (Modular production plant for heavy-duty hybrid components), which also involves Fraunhofer ICT and nine other partners. They developed a modular production system for hybrid components, combining an Arburg injection unit for fibre direct compounding (FDC) with a Dieffenbacher 3,600-tonne vertical press (see *Injection World* Jan/Feb 2019).

"Based on the positive results achieved in the MoPaHyb project, we will in future also be offering Dieffenbacher transfer moulding presses in combination with an Arburg FDC injection unit," says Manfred Reif, Head of the Composites Business Unit at Dieffenbacher. "Together with our Fiberforge UD tape laying system and the Fibercon consolidation unit, we can offer our customers a strong overall package."

Arburg and several key players are also involved in the FOREL FuPro project in Germany. FOREL is a nationwide, open platform for the development of lightweight system solutions in multi-material designs for future electric vehicles. FuPro is now focusing on closed hollow profiles with continuous fibre distribution, combined with thermoplastic fibre-plastic composite structures.

During the implementation phase, Arburg had the task of manufacturing parts by over-moulding using FDC. "Over the course of the project, however, it became apparent that a special gripper technology was required on the six-axis robot [from Kuka] for handling, stabilising and draping the flexible thermoplastic composite sheet," it says. (The sheet in question is Tepex Dynalite 102-RG600 based on roving glass fabric and a polyamide 6 matrix, made by Lanxess subsidiary Bond-Laminates.) The KUKA robot works in collaboration with one of Arburg's Multilift robotic systems. Working with various partners, Arburg developed a gripper that combines aluminium and additively manufactured (using its Freeformer technology) components. Ultimately, the tube-like components in combi-



IMAGE: KRAUSSMAFFEI

Right: Door module carriers made using KraussMaffei's Fiberform technology

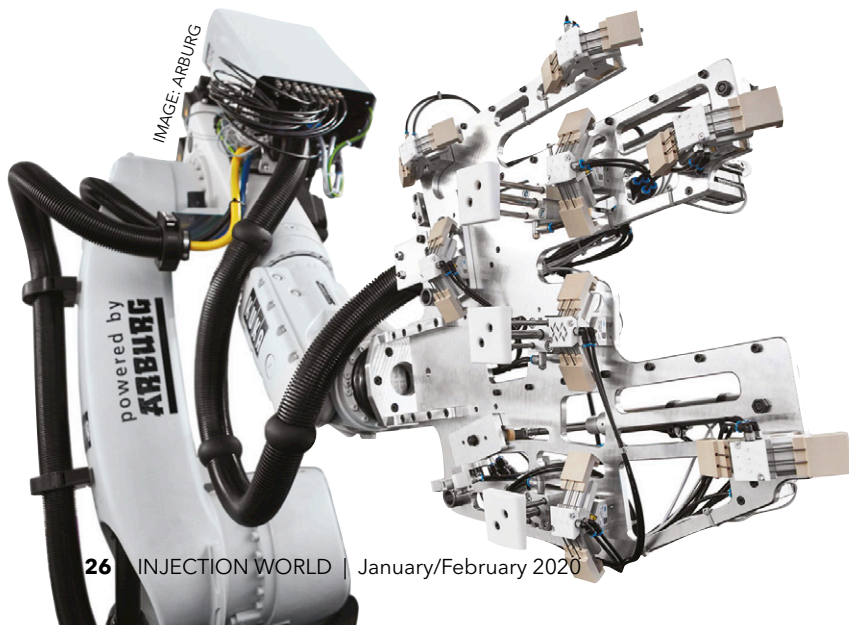


IMAGE: ARBURG

Left: For the automated production of the backrest demonstrator within the FuPro project, Arburg developed a special gripper technology which enables safe handling, stabilisation and draping of the thermoplastic composite sheets



Plastic Closure Innovations

Connecting the industry to explore the latest technical developments and trends

SAVE €200*

when you
book before
3 April 2020

1-3 June 2020, Meliá Sitges, Barcelona, Spain

Photos courtesy of : APTAR, BERRY GLOBAL



Also sponsored by:



Media supporter:

**Injection
WORLD**

*Discount cannot be retrospectively applied or used in conjunction with any other offer

Plastics Regulations

BOOK
TODAY

11 - 12 March 2020

Pullman Cologne,
Cologne, Germany

Responding to new and future regulatory developments that will impact on the plastics supply chain

www.ami.ltd/attend-reg

Sessions cover:

- A global outlook on legislation
- Recycling and waste strategies for the circular economy
- The regulatory view on sustainable materials
- The Outcome of the framework review and the implications for the plastics industry
- Updates on NIAS and FCM
- Exploring additive and chemical regulations

ALSO INCLUDING

Brexit Workshop

Tuesday 10th March 2020

Our Brexit workshop looks at aspects effecting both European and UK businesses. Take advantage of this workshop and join us to learn about protecting your business from potential threats post-Brexit.

BOOK YOUR PLACE TODAY

Industry speakers include:



Dr. Stamatios Stamenitis

Senior Principal Scientist SRA

MARS WRIGLEY



Mr. Marcus Navin-Jones

Partner



KELLER AND HECKMAN LLP
SERVING BUSINESS THROUGH LAW AND SCIENCE®



Dr. Anna Gergely

Director, EHS Regulatory

Steptoe



Mr. Siegfried Richter,

Policy Officer



Ms. Bonita Reynolds

Sr. Director, Authoring Services



Verisk 3E™

Intelligent compliance. Sustainable progress. A safer world.



Mr. Job Ridderbecks,

Food Contact Technical Specialist

intertek

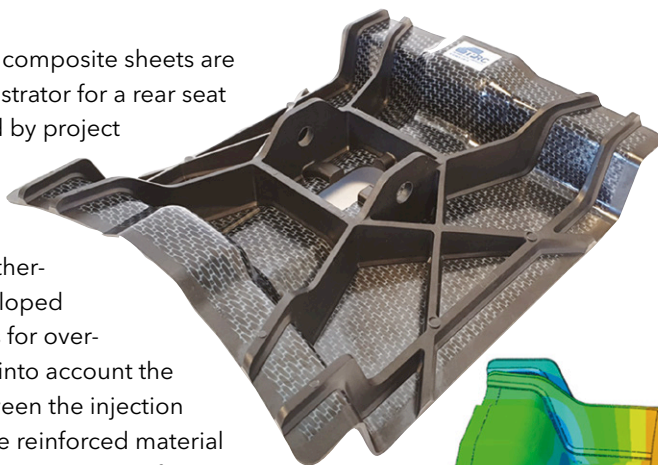
Total Quality. Assured.

SPECIAL OFFER! Book now for **€150 discount** input code REG20EU

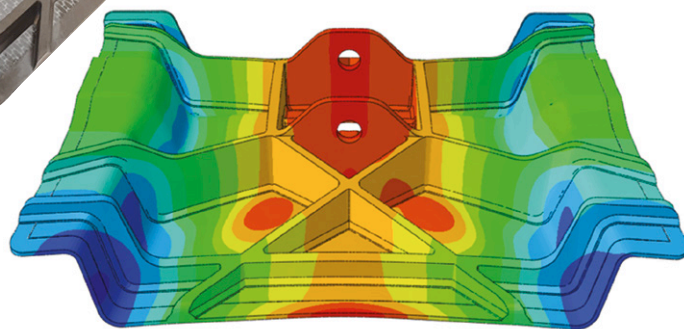
nation with the thermoplastic composite sheets are to be used to create a demonstrator for a rear seat backrest, which was designed by project partner Brose Fahrzeugteile.

The **TPRC (Thermoplastic Composites Research Center)** in Enschede, The Netherlands, reports that it has developed structural analysis capabilities for over-moulded structures that take into account the strength of the interface between the injection moulded and continuous fibre reinforced material domains. The virtual environment consists of several software packages, as well as a Degree of Melting (DoM) model which was developed in the Composites OverMolding Production TEchnology (COMPeTE II) project. The stamp forming step is simulated with AniForm from which the fibre directions are exported to the structural simulation Abaqus. The injection moulding step of the over-moulding process is simulated in Autodesk Moldflow. The interface temperature history is exported to the DoM model and the short fibre orientations and initial strain-state are exported to Abaqus via the Autodesk Advanced Material Exchange.

The DoM model predicts the amount of crystallites that is being dissolved in the insert during the over-moulding process for semi-crystalline materials. This determines the maximum attainable interface strength as the crystallites severely impair the bonding process between the two material domains. The DoM prediction is then correlated with mechanical testing data, using a newly developed test geometry, to create a quantitative



Left: Demonstrator geometry with woven insert developed during COMPeTE II



Below: Structural analysis of the demonstrator geometry

interface strength prediction.

A demonstrator geometry part developed in the COMPeTE II project allows for mechanical testing and is used to validate the structural analysis capabilities. The simulation results show good correlation with the observed deformation mode and strength during mechanical testing of the demonstrator geometry, says TPRC.

Materials

Ineos Styrolution introduced a new generation of thermoplastic over-mouldable composites called StyLight at K 2016. The company says the material, based on a modified SAN (styrene acrylonitrile) matrix reinforced with glass or carbon fibres, produces parts with very good surface aesthetics. ➤

Tape inserts in injection moulding

Tape inserts offer enormous potential for injection moulding parts. That's the conclusion of a major consortial project led by the Aachen Center for Integrative Lightweight Production, **AZL**, and the Institute for Plastics Processing at RWTH Aachen University, **IKV**. For suitable components, product costs and component properties can be positively influenced, they say.

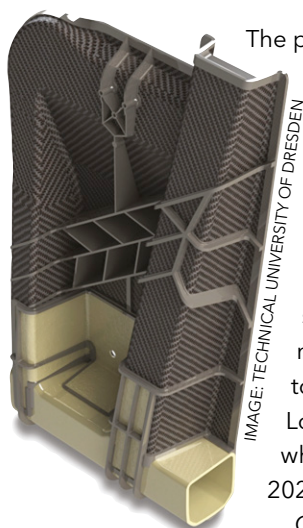
"We are so satisfied with the progress and results of the study that we have already defined several follow-up projects and are also forming a consortium for the short-term identification and implementa-

tion of new applications," says Prof. Christian Hopmann, founding professor of the AZL and head of the IKV.

In cooperation with 20 industrial partners, the AZL and IKV carried out a detailed analysis of tape inserts in injection moulded components over a period of eight months. The tapes, which are a few tenths of a millimetre thick, are continuous fibres, typically made of glass or carbon, completely impregnated and embedded in a thermoplastic matrix. The tapes can be precisely aligned to the loads in a component and are used primarily in high-performance applications with

the aim of weight reduction.

The aim of the conducted analysis was the identification of potential applications and the estimation of a wider range of applications. "We know that the integration of small amounts of high-performance tapes into typical injection moulded parts can contribute significantly to material savings in their manufacture. Lightweight construction is only a secondary effect, one of the main drivers for establishing the technology is cost reduction," says Dr. Kai Fischer, who heads the fibre-reinforced production technology unit at the AZL.



The portfolio has been growing ever since. In 2018, Ineos Styrolution introduced a "carbon look" version, StyLight Aesthetic S C200-1, with higher fibre density and improved stiffness, followed by a PP-based version. A representative says the material is particularly popular in the automotive, electronics and the toys/sports/leisure industries. The success of the material led to plans, announced last April, to build a dedicated production site. Location has not yet been decided, but wherever it is, it should be operational in 2022.

Above: A demonstrator for a rear seat backrest is being developed in the FOREL FuPro multi-partner project in Germany

One of the latest examples of how **Lanxess's** Tepex continuous-fibre-reinforced thermoplastic composite materials can be used in injection moulding to produce lightweight structural components is an A-pillar developed by Porsche's 3D hybrid design, intended to improve crash safety in convertibles and roadsters. It has been employed for the first time in the Porsche 911 Cabriolet.

The pillar contains an insert made from high-strength steel. This is supported from the inside by a formed blank of the polyamide-6-based Tepex Dynalite 102-RG600(6)/47% and by a ribbed structure made from Durethan AKV30H2.0 short glass fibre reinforced PA66. This



Right: Rome snowboard binding

structure is bonded by friction with a structural foam. "The strength and rigidity of the hybrid insert ensures that the A-pillar is just as good at withstanding rollovers as previous designs featuring high-strength steel tubes," says Lanxess. "However, it is around 5kg lighter."

Through its HiAnt customer service operation, Lanxess provided Porsche and part producer L&L Products with extensive support in the development of the hybrid inserts and the A-pillar. "Services included simulating the forming (draping) of the Tepex blanks, simulating filling for back-injection and calculating warpage. We also determined material characteristics to simulate the mechanical behaviour of the A-pillar and made these figures available to Porsche," says Jean-Marie Olivé, expert in application development at Lanxess.

PolyOne bolstered its composites business almost four years ago when it acquired Polystrand, which makes tapes and multi-ply laminates suitable for over-moulding. One example is equipment for winter sports from Rome Snowboards.

In creating its Black Label, Rome sought to add what is known as a premium "high-back" to its binding collection that would be flexible and durable, providing highly responsive performance in an ultra-light, high-tech binding.

The design team at Rome worked closely with the PolyOne Advanced Composites technical team and a local thermoformer, trialling various

Injection Moulding in Europe Industry Value, Structure & Market Dynamics 2019

**NEW from
AMI Consulting**

Discover the scale and structure of the European thermoplastic injection moulding industry in 2018 and prospects for 2023.

Our new report provides extensive details of the industry in terms of:

- Polymer demand by polymer type
- Markets served
- Value of the industry
- How many machines, how many moulders, what markets are they serving and who are the largest?

FIND OUT MORE



Toray Advanced Composites will produce CFRT tapes using BASF's Ultramid PA6



IMAGE: BASF

combinations of engineered resin and reinforcement, fibreglass content, and laminate configurations. "Ultimately, a Polystrand 8-ply fibreglass reinforced PETG laminate over-moulded in nylon hit the sweet spot - providing just the right ratio of flexibility and strength that makes the binding worthy of a premium designation," says PolyOne. "The injection-over-moulded Polystrand composite construction in Rome's Black Label binding is the first of its kind in the industry."

Last August, **Toray Advanced Composites** and **BASF** signed a manufacturing and supply agreement focused on the production of continuous fibre reinforced thermoplastic (CFRT) tapes for the automotive and industrial markets. Toray Advanced Composites will produce high quality and affordable CFRT tapes using Ultramid engineering thermoplastics developed and produced by BASF. The fibre manufacturer will reinforce BASF's Ultramid PA6 resins with either glass fibre or carbon fibre.

Toray Advanced Composites' CFRT materials are said to be compatible with a wide range of BASF's Ultramid compounds, based on various types of polyamide, enabling more efficient, multifunctional parts to be produced in fewer steps and with less labour compared to more traditional methods.

CLICK ON THE LINKS FOR MORE INFORMATION:

- > www.engelglobal.com
- > www.brose.com
- > www.kraussmaffei.com
- > www.arburg.com
- > <https://dieffenbacher.com>
- > <https://tprc.nl>
- > www.styrolution.com
- > <https://lanxess.com>
- > www.polyone.com
- > www.toraytac.com
- > www.basf.com
- > www.azl.rwth-aachen.de
- > www.ikv-aachen.de

New unit for in-situ polymerisation

An alternative to over-moulding of fibre reinforcement preforms by melt processing is in-situ polymerisation. **Engel** first demonstrated how this could work on a global stage at K 2016, and it continues to develop the technology. It says the decisive factor for processing efficiency and product quality is the reaction unit that it has developed specifically for the preparation and injection of caprolactam (which polymerises into polyamide 6).

Engel has further optimised its solution with a new, smaller reaction unit. This can handle matrix volumes between 10 and 600 cm³, which the company says offers great flexibility, especially for technology centre plants, in the production of test parts, specimens and parts up to a weight of 1.5kg. One benefit of the system for R&D operations with frequent recipe and batch changes is that residual material can be quickly removed without the system needing to be flushed. The larger unit can process matrix volumes of up to 1,500 cm³.

Both sizes of the reactive unit can be combined with any Engel injection moulding machine. A retrofitting option is available for injection moulding machines with the CC300 control unit, or the reactive unit can work as a stand-alone system with its own CC300 control.

The moulding process with caprolactam is a cross between injection moulding and resin transfer moulding, which has been used for a long time to make composites based on thermosets. "Thanks to caprolactam's low viscosity in molten state, the dry fibres can be wetted particularly well," Engel says. "Compared to duroplastic [thermoset] RTM, longer flow paths and a higher fibre content are possible."

Engel says the range of applications for in-situ polymerisation extends from small parts with thin wall thicknesses through to large, highly stressed structural elements.



IMAGE: ENGEL

Above: Engel's solution for in-situ polymerisation of caprolactam into PA6 for the production of fibre-reinforced thermoplastic components is characterised by particularly compact system technology

Polymer Foam

Exploiting innovation in polymer foam
materials, processes and applications

SAVE \$300*

when you
book before
March 20, 2020
Use code
EBC1061

June 23-24, 2020, Pittsburgh Marriott City Center, Pittsburgh, PA, USA



Media supporter:

Compounding
WORLD

*Discount cannot be retrospectively applied or used in conjunction with any other offer

We preview AMI's Polymers in Footwear conference in the US in April with insights from experts speaking at the event

Footwear brands get on sustainable track

AMI's second US edition of Polymers in Footwear offers industry professionals from North America and beyond the opportunity to hear from brands on latest market developments and future trends, learn about new sustainable materials and network with key stakeholders from the entire supply chain. The conference takes place on 7-8 April 2020 at the Portland Marriott Downtown Waterfront, Portland, Oregon, US.

Polymers in Footwear offers a unique opportunity to discuss trends and innovations and network with key stakeholders from the entire supply chain.

The event features an end-user panel giving a market overview, discussing trends and providing a future outlook. Further conference sessions cover green materials and sustainable solutions for the new consumer, adhesives and bonding technologies, innovations driven by footwear science and custom fit technologies, as well as eco-friendly supply chain practices.

The high-level speaker line-up includes representatives from **Saucony Human Performance and Innovation Lab, Vivobarefoot, The Footwearists, Simplicity Works, Huntsman, Covestro, Evoco** and many more.

To learn more about market developments and future challenges, we spoke to some of the experts who will be sharing more insights at the event.



Dr. Daniel Dempsey, Senior Additive Manufacturing Engineer, New Balance Athletics, US

How do new developments in footwear manufacture drive innovation?

Primarily performance attributes are driving product development and customer expectations to a greater degree than in the past. This trend is largely due to the recent influx of carbon fibre plated midsole constructions and the capability for brands to provide quantitative data of performance improvements rather than qualitative statements of product performance. Recent trends indicate that customers are willing to pay a premium for these pinnacle products as the data behind the construction does infer performance improvements in the field.

Additionally, with the prevalence of social media, brands are more accountable to the aggregate voice of the customer as well as the board of directors. Not surprisingly those voices are not calling for cost reductions but rather a more unique construction, a better or more intentional function, and moreover a better hand to the environment. Some brands have executed on this theme better than others, but either way it will be interesting to

POLYMER TESTING **WORLD EXPO** **NORTH AMERICA**

November 4 - 5, 2020
Huntington Convention Center
CLEVELAND, OHIO, USA

Connect with your target customers



Connect with your target customers in a cost-effective and time-efficient way at
AMI's brand-new focused exhibition for the polymer testing industry.

More than 200 exhibitors have already signed up
for the Cleveland shows including:



Brabender[®] **CWB**



KONICA MINOLTA



NETZSCH
Proven Excellence.

ThermoFisher
SCIENTIFIC

and many more...

To book your booth, contact:
exhibition_sales@ami.international
+1 610 478 0800
na.polymertestingexpo.com

**BOOK
YOUR
BOOTH**

Brought to you by:



Colocated with:



see, in the next couple of years, which sustainability path means the most to the consumer, reclaimed and recycled materials or increasing the feedstock from renewable resources.

What are your predictions for the footwear industry in the next 3-5 years?

Really the next couple of years for the footwear industry are going to be about focussing on supply chain refinements to eliminate inefficiencies and mitigate scrap. Generally speaking, carrying large amounts of stock on cyclical and fashion influenced products is a risky endeavour and all brands will be focussing on how to cut the fat out of their supply chains. Increasing speed to market by compressing the development cycle will be an important aspect of cutting down on excess stock.

These initiatives can be supported by digital design and manufacturing tools such as 3D modelling and rendering, 3D printing, and knitting technologies, as well as other digital tools.

Sustainability will be the largest theme going forward with all companies striving to eliminate scrap in production, increase utilization of renewable resources in raw feedstock, incorporating recycled materials in their construction, extending product lifecycles, and determining how to recycle product at end of life.



**Kui Cai, Design Director,
Peak Sports USA Design
Center, US**

What are the latest footwear materials and technology developments?

As a designer, I'd like to say that the latest and the most exciting footwear materials are the ones that focus on the sustainable, "closed-loop" systems. From a technological standpoint, 3D printing pushes the entire sustainable design idea forward; not just increasing the efficiency of material use but also making changes from the very fundamental (it could roughly save up to 80% of the processing expense and manpower compared to the traditional process).

What are the three trends shaping the future of the footwear industry?

Sustainability is one of the key trends that shape the future. Over 20 billion pairs of shoes are made annually worldwide and about 90% end up in incinerators or landfills. Environmental protection is a responsibility for everyone. And I am glad that now we can finally try to create a balance between

economy and sustainability. Digitalization would be another huge hit to the footwear industry. Virtual reality tools enable designers to "hold" their imaginations in hands and present in fast and convincing ways to their audiences.

More and more individual artists and designers start doing their own "reconstructing" and customized footwear. It is very inspiring to see how they are trying different ways to mix and match or repurpose various materials and parts to create something new. Hyped by social media platforms, they are getting an unbelievable amount of attention from consumers and it has become quite a trend that could not be neglected.



**Dr. Romesh Patel, Senior
Manager, Materials
Innovation, Allbirds, US**

What are the key material innovations to look out for in the near term?

Our materials innovation strategy is to look at every single material component in our shoes and start choosing preferred materials wherever possible without compromising on performance. We tally up our list of materials and start with the most impactful materials first and work down the list. We feel very positive about our current Hero material choices (ZQ-wool, FSC-Tencel, and sugar-based EVA) because they are helping us clean up the incoming stream of raw materials. Materials innovation and their method-of-make go hand in hand.

In addition to our continued pursuit for high bio-contents in our current materials, we are also working on using more thermoplastic polymers that would enable circularity. However, these new materials will not be processible in existing equipment and may require new processing capabilities. We see this as an opportunity to drive down our carbon footprint even further.

What are the main targets for sustainability?

It's still surreal just how dated the shoe making process is. Though there are some futuristic factories that give us insights on what is possible, the truth is that a vast majority of the shoes are more or less still made just as they were 50 years ago. If we want to build a circular economy, we need to be able to collect old shoes and easily take them apart in the end.

■ See booking details for **Polymers in Footwear** at the [conference website](#).

Fire Retardants in Plastics

Cleveland / 2020

*Exploring trends and technical developments
in the international flame retardant industry*

March 31 - April 1, 2020

The Westin Cleveland Downtown, Cleveland, Ohio, United States



**CLICK
HERE FOR
DETAILS**



Sponsored by:



Media supporter:



Bringing the plastics industry together.

   @Contact_AMI #AMIFireUS



Materials suitable for wearable devices and plastics with enhanced chemical resistance are just two of the trends driving the medical plastics materials market forward. Mark Holmes reports

Expanding the healthcare role for plastics

The medical and healthcare industry continues to find an increasing number of applications for injection moulded plastics. They offer a wide range of important properties for materials for medical devices, while providing ease of processing for ever smaller and more complex moulded medical parts and devices.

RTP Company cites three significant medical market trends for plastics currently – surgical robotics, wearable drug devices and drug delivery pens. “Surgical robotic systems are becoming more prevalent because they are minimally invasive and precisely accurate, which helps the patient recover more quickly; there is a need for lightweight, durable plastic parts for these,” says Bob Williams, Global Account Manager, Healthcare. “Also, as the US population ages, there is more demand for wearable drug devices and drug delivery pens, which include plastic components that are some-

times laser marked and/or laser welded together. Other issues driving developments in materials include regulatory changes, such as ISO 10993-18 updates, REACH, (EU) Number 2017/1000 concerning PFOA, and PVC restrictions, which can drive medical companies to do more research up front on the plastics they are using and to look for more cost effective design alternatives.”

He identified other trends within the medical industry that are helping to drive material development, such as lightweight tools and equipment, better performing drug delivery systems, and materials that can withstand cleaning and sterilisation.

“In addition, medical facilities are seeking new ways to reduce hospital-acquired infections, and this has prompted a need for plastics that resist damage caused by aggressive cleaners. When strong cleaning solutions are used for killing germs on medical equipment, handheld devices, moni-

Main image:
Plastics feature in devices for health monitoring, drug delivery, surgical procedures and more



IMAGE: RTP COMPANY

Above: Compounds from RTP Company can be specifically formulated to provide strength, durability, wear resistance, and more for surgical robotics systems, monitors and instruments

tors and tablets, for example, the plastic housings and components can become brittle and crack. This is driving the need for plastics that can withstand these harsh chemicals," said Williams.

"Drug delivery devices also require new solutions. Smart, wearable drug devices can include internal components that need to resist electrical interference, so plastics with EMI shielding are required. And more advanced drug delivery pens require new lubricious plastics to minimise the sticking of the needle for patient comfort and more even flow of drug disbursement."

As a custom compounder, RTP Company says that it develops specific solutions for customers, supporting them through material selection, product development and regulatory changes, for example. The company adds that its expertise includes a broad spectrum of material solutions, including lubricious and wear-resistant compounds, more chemically resistant alloys, conductive plastic technologies, TPE medical grades, and proprietary thermoplastic technology with functional additives for radio opacity, laser welding, and laser marking.

In order to meet the need for plastics that can resist damage caused by harsh chemicals, RTP developed a product called RTP HC-2000 that withstands these aggressive cleaners. The HC-2000 Series is available in a UL V-0 version, and is superior to PC/ABS and PC/PBT blends in terms of chemical resistance, the company says. This material reduces cracked housings and returned devices for OEMs. For manufacturers of drug delivery devices, RTP Company adds that it has formulated a range of EMI shielding compounds and lubricious, wear-resistant compounds to solve a variety of issues for wearable devices and injection pens.

The use of electronics is increasingly permeating

the medical device market, according to US-based **Foster Corporation**. "This involves a big growing segment of wearables and portables, where patients now monitor their health not only with portable devices from home, but also on their wrists," says Larry Johnson, Vice-President Business Development. "Medical device companies are recognising the trend and, more often, we are seeing developments involving convenient devices that can be used outside of hospitals."

He continues: "Miniaturisation is also a major trend as medical devices are getting smaller in order to get closer to the body areas that need therapy. A consequence of this trend for plastics compound functionalisation is making sure that particle sizes of inputs are 'in-line' with the size requirements of the products being made. Additionally, as medical devices become more sophisticated, the demand for strong quality systems, regulatory compliance, bio-regulatory information and other services are the minimum requirements for suppliers of the industry."

There is also a need for more durable, chemical-resistant materials. "Devices, such as medical equipment housings, are now exposed to more frequent washing and cleaning to deter the spread of infections," adds Johnson. "Hospitals are using thorough cleaning procedures and products which could significantly affect the integrity of the device housing. In the wearable [tech] space, devices are exposed to grease, oils, soaps and creams, for example, hence the chemical resistance still plays a big role in that segment."

The company adds that an adjunct to the trend in miniaturisation in injection moulding is micro-moulding. While devices are getting smaller, the requirements for precision are also increasing. This means materials must flow adequately and provide the required part precision. In addition, filler and functionality particle sizes must also allow part filling and precision requirements as well.

Customised procedures are looking to personalise the whole patient treatment spectrum. This includes anything from customised prostheses that will fit perfectly in the patient's body to bioresorbable materials that target specific reabsorption rates. In addition, laser marking, electrical conductivity, specific permeability and functional colour indication are common issues that require new material solutions; while complying with stringent regulatory requirements and allowing for injection and micro-injection moulding processability. Secondary processes also require a choice of resins with appropriate 'surface energy' to allow procedures such as welding, bonding and printing. ➤



Polymer Sourcing & Distribution

Disruptive forces, challenges and opportunities
in global polymer sourcing & distribution

SAVE €200*

when you
book before
6 March
2020

12-14 May 2020, Marriott Hotel, Hamburg, Germany



Also sponsored by:

PLASTICFINDER
The number one online plastics marketplace

Media supporters:

Compounding
WORLD

Injection
WORLD

Film and Sheet
EXTRUSION

Pipe and Profile
EXTRUSION

Plastics Recycling
WORLD

*Discount cannot be retrospectively applied or used in conjunction with any other offer

NEW REPORT

Thermoplastic Masterbatches in Europe

Strengthen your business growth strategy in the European market for 2020

**FIND
OUT
MORE**

Access comprehensive industry analysis answering questions including:

- How will the circular economy impact applications and market growth?
- Which markets are growing in application and geographical contexts?
- Where are new opportunities arising?
- What are the strategies of the key producers and how will they succeed in the future?

CONTACT US

T/ +44 (0) 117 314 8114

E/ sales@ami.international

W/ www.ami.ltd/MB-EUReport



Robust research and expert data for the global plastics industry



Foster Corporation adds that it has recently launched LazerMed for applications requiring laser marking. "As a custom compounder, we provide customer/application specific solutions leveraging our knowledge on materials and additives for the industry," says Johnson. "We use many different additives to provide our customers with solutions to achieve improved performance in the areas of lubricity, colour technologies, taggants and anti-counterfeit, and antimicrobial requirements. We also announced our partnership with LioChem, at the end of 2019 in an effort to serve the market with high quality colour masterbatches that are compliant with medical device regulations and can be obtained in the appropriate quantities for inventory management."

The company says that LazerMed is a technology for materials that require laser marking as an alternative to solvent based printing technologies for medical device applications. It is dispersed through compounding processes which warrants the uniformity and consistency of the marking. It can be used in a wide variety of materials providing improved contrast and a safe option for the market. Other custom solutions target specific requirements like electrical conductivity for wearable applications that require thermal isolation, colour technology for dental applications with specific regulatory requirements, lubricious/waterproof compounds for closure systems that reduce the risk of jamming during utilisation, and a speciality bioresorbable compound for bone screws that keep their integrity for a specific period of time and foster bone growth (reducing healing time for patients).

There are a number of future targeted material developments at Foster Corporation, concludes Johnson. These include: enhanced lubricity additives that perform under wet condition; compounds with bone growth additives for orthopedic applications; radiopaque additives for enhanced processability and dispersion; antimicrobial solutions for

equipment housing; improved strength medical grade polymers; and technologies that enable alternative imaging techniques.

Injection moulded parts used in medical applications require precision manufacturing under strict performance qualifications, including highly challenging tolerance levels and multi-cavity tooling, says **Topas Advanced Polymers**, a Polyplastics subsidiary which manufactures Topas COC. These are often produced in complex geometries and tight tolerances of less than 0.001 in (0.025 mm). Materials for medical parts must be able to meet these increasing design and manufacturing challenges. Topas COC offers high flow, good dimensional stability for automated demanding production criteria of medical and diagnostic companies worldwide. Topas COC can be moulded for maximum precision.

Topas Advanced Polymers adds that medical applications in drug delivery and diagnostics require polymers with a high degree of purity, drug compatibility, biocompatibility, and dimensional stability. The need for these critical properties continues to grow with the proliferation of point-of-care (POC) and wearable technologies, as both established, and start-up companies are focusing on developing products in this emerging space.

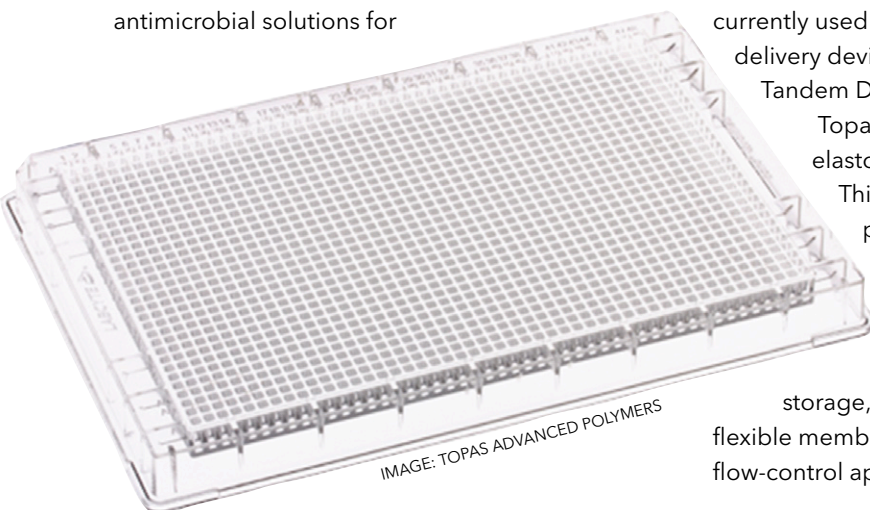
As a leading healthcare plastic and drug-contact material, Topas COC provides these features, while delivering consistent and reproducible performance, says the company. The properties of Topas COC also help to facilitate the continuing miniaturisation of products in the industry.

According to the company, unlike other engineering thermoplastics or glass, Topas COC offers a non-ionic, minimally reactive surface. This non-polar substrate does not promote adsorption, denaturation, aggregation or precipitation. With very low leachables and extractables, the material preserves long-term drug purity, enabling better performance and patient safety. Topas COC is currently used in commercial wearable drug delivery devices, including Valeritas' V-Go and Tandem Diabetes' t:slim X2.

Topas COC is also available in an elastomer grade, Topas Elastomer E-140.

This highly flexible grade is a high-performance alternative to traditional flexible materials for a broad range of applications such as gaskets, medical devices, speciality pharmaceutical packaging and storage, medical tubing, IV bags and as a flexible membrane in demanding diagnostic and flow-control applications. Similar to standard Topas

Left: Topas COC offers high flow, good dimensional stability for automated demanding production criteria of medical and diagnostic companies



COC grades, the elastomer is a high-purity resin with low leachables and extractables, and good chemical resistance. The company says E-140 also offers exceptional barrier properties compared with other elastomeric materials, allowing it to deliver additional product shelf life.

Importantly, the elastomer is compatible in assemblies with a rigid COC, like grade 5013L-10. Among other advantages, this property facilitates multi-material moulding and eliminates concerns about cracking and other structural deficiencies that may develop from incompatible materials. The resin, which is also suitable for microfluidic applications, offers good clarity, high flow without loss of material strength or optical properties, and heat resistance to 127°C.

New product evaluations show that Topas Elastomer possesses strength and stiffness suitable for numerous flexible applications. Tensile modulus is reported at 6,400 psi while elongation at break is greater than 450%. In addition, the material's low dielectric properties are comparable to some fluoroelastomers, providing strong electrical insulation performance. Another key feature is the material's ability to maintain good ductility at temperatures below -90°C. The grade has an 89 Shore A hardness and meets USP Class VI requirements for use in medical devices. It also complies with US FDA food-contact regulations as detailed in FDA FCN 1104.

Elkem Silicones observes two main trends with plastics for medical application. "There is an increase in at-home care and diagnostics devices, which requires comfort and durability that can withstand consumer handling and care," says

Michael Goglia, Healthcare Market Manager for the Americas. "We also see an increase in wearable devices, which require softer, smaller and durable designs. Often wearable devices include wireless electronic reporting functions requiring batteries. These devices must be moulded at lower temperatures to avoid damage to the batteries. Other medical moulding issues include challenges in the industry for two-shot and overmoulding at low temperatures to maintain the integrity of the plastic, circuit board and battery, for example. Another challenge is friction or drag."

He continues: "In order to address the challenges of two-shot and overmoulding, we have developed and introduced Silbione LSR Select, which is a patented advanced system of LSR materials that enables users to achieve multiple capabilities all in one solution. These include low temperature cure. With LSR Select users can achieve cure at temperatures as low as 80°C and below. It also offers formulation flexibility. Users can now custom blend LSR Select in line to obtain desired durometer performance from 20 to 70 Shore A. Productivity improvements can also be achieved by enabling users to optimise cure kinetics resulting in improved cycle times up to 50% and beyond."

In order to address the challenge of friction and drag of silicone in combination with plastics, Elkem Silicones has developed a healthcare grade self-bleeding series, Silbione LSR 4700. The company says that this medical grade LSR series, available in 45, 55 and 65 durometers, creates a lubricious surface on the moulded part after vulcanisation. The material is designed to minimise friction and prevent slit healing in applications. Built into the bulk LSR formulation, the self-bleeding lubricity of this product line eliminates the need for a secondary coating process to reduce coefficient of friction, reducing costs and improving cycle time for the part manufacturer.

Elkem Silicones has recently been involved with a customer looking to consistently deliver tight durometer specifications for a small part, just 2-3g, with a 25s cycle time. "The customer's pain point was not necessarily cycle time, but rather tightening the durometer consistency to ±3 points, over six different durometers," says Goglia. "Thanks to the blending capability of LSR Select, we were able to achieve all six durometers blending just two base materials, a 20 Shore A and a 70 Shore A. We were able to hone in the desired specific durometers by fine tuning the blend in-line, enabling the part manufacturer to consistently achieve part specification parameters. As a bonus, we also improved cycle time by 32%. In addition to

Table 1. Typical properties of two Teknor Apex medical grade TPEs for overmoulding on to polycarbonate and PC alloys

Properties and Units	Medalist Medical TPE Compounds	
	General-Purpose MD-34969	Wearable Applications MD-36975
Density, g/cm ³	1.10	1.10
Hardness, Shore A (5 sec.)	73	75
Tensile strength, psi/MPa	907 / 6.25	576 / 3.91
Tensile elongation %	562	130
100% Modulus, psi/MPa	454 / 3.13	561 / 3.87
Chemical Resistance, 70% Isopropyl Alcohol Wipe Test		
Tensile strength change %	-6.9	1.4
Tensile elongation change, %	-7.3	5.4
Chemical Resistance, Suntan Lotion Wipe Test		
Tensile strength change %	-8.8	-4.9
Tensile elongation change, %	-9.1	0.0

Source: Teknor Apex Company

addressing the customer's primary needs, LSR Select also offered secondary benefits of increased productivity by not having to change out the material for each durometer change, less inventory required with all six durometers achieved through two bases, and more part production capability via the improved cycle times."

The company has also been involved in a project related to low temperature cure for overmoulding printed circuit boards. "In this case, we had the challenge of overmoulding silicone to a printed circuit board for a wearable monitoring device," says Goglia. "When moulding these circuit boards with standard two-component LSR at 135°C, the circuit boards were destroyed and non-functional. With LSR Select, we were able to bring the temperature down to 100°C and successfully overmould the circuit boards with no damage to the boards and maintain full functionality of the device, with data successfully transmittable to the software after being moulded."

Teknor Apex has introduced a new series of Medalist medical-grade thermoplastic elastomer (TPE) compounds for overmoulding that exhibit strong adhesion to medical-grade polycarbonate and PC alloys and include formulations with enhanced resistance to chemicals encountered in wearable applications. Medalist MD-34900 series compounds, available in 50, 60, and 70 Shore A grades, are for general medical overmoulding applications, while the MD-36975 grade is a 75 Shore A TPE designed specifically for overmoulding in wearable devices, with good resistance to the lotions and disinfectants that are typically encountered.

In a joint project with Covestro, these materials were overmoulded onto various medical grades of Makrolon PC, as well as Bayblend and Makroblend PC alloys, using both insert and multi-shot moulding. The project included tests to evaluate adhesion, processability and chemical resistance. Peel strength data showed the Medalist compounds exhibiting good adhesion to Covestro's engineering thermoplastics.

Teknor Apex recommends the new Medalist compounds for wearable devices, where TPEs contribute comfort; soft-touch or cosmetic grips for medical device housings, handheld devices, and instruments; and seals and gaskets. The table on the previous page presents typical properties of representative grades from each series.

"Medalist TPEs are excellent alternatives to liquid silicones used in overmoulding because they do not require the use of a primer, have a shorter cycle time (avoiding the lengthy curing process),



IMAGE: APOLLO NEUROSCIENCE

and can be processed on conventional injection moulding equipment," says Ross van Royen, Senior Market Manager for Teknor Apex.

The new compounds for the medical device industry are an outgrowth of work carried out by Teknor Apex to develop overmoulding TPE formulations for consumer products. "We've made substantial investments in adhesion-modified technologies for TPEs, increasing our understanding of adhesion, developing more cost-effective formulations, and improving the bonding capabilities of these products in complex part designs," says van Royen.

The Medalist MD-34900 series and MD-36975 compounds are available worldwide. As medical-grade TPEs, they are subject to strict formulation controls, are made only with FDA-listed food-grade ingredients, are ISO 10993-5 compliant for biocompatibility, and are compliant with CONEG, RoHS, and California Proposition 65 requirements. Teknor Apex produces these compounds in multiple ISO-13485-certified facilities, ensuring security of supply.

Covestro has supplied a tough and chemical-resistant Makroblend M525 PC and polyester blend for the light and durable Apollo wearable. Developed by Apollo Neuroscience, the Apollo is the first wearable that helps the body beat stress by rapidly restoring its natural equilibrium, resulting in better sleep and energy, for example. Rather than just tracking your body, the company says that this device uses vibration to improve your recovery time from stress. Apollo claims that the device's gentle vibration waves signal safety to the body and improve heart rate variability through the sense of touch.

It was originally developed by physicians and neuroscientists at the University of Pittsburgh. Consumers can wear Apollo on the wrist or ankle, which exposes the device to personal care products, such as lotions, perfumes and detergents. The device is able to withstand these everyday products,

Above:
Covestro
Makroblend
M525 PC and
polyester
blend lends
toughness and
chemical
resistance to
the Apollo
wearable



Above: Evonik has developed a highly transparent polyamide based on new monomers suitable for medical applications

along with bumps, drops and daily wear and tear.

Evonik has introduced a bioresorbable portfolio of PLA-PEG copolymers for use in implantable medical device applications. The company says that the range expands its ability to help medical device customers enhance the safety, biocompatibility and performance of their implantable products, and further strengthens its growth in the health and care market. Resomer PLA-PEG copolymers combine the hydrophobic properties of PLA materials with the hydrophilic properties of PEG. As triblock copolymers, the portfolio can replicate the mechanical strength of standard Resomer polymers but enables degradation rates up to six times faster. This combination of strength and rapid degradation allows medical device companies to develop a new class of bioresorbable implant devices for use across application areas, such as wound closure and paediatrics, that better match the natural healing process of the patient.

Four Resomer PLA-PEG grades with degradation rates of between six and 12 months or less have been developed within the standard Resomer catalogue. A range of customisation options are also available under Resomer Select. They are claimed to be easy-to-process, compatible with all relevant technologies, and provide long-term stability.

Evonik has also developed a highly transparent polyamide based on new monomers, which combines a relatively high heat deflection temperature with good mechanical properties and low water uptake. Trogamid HT is ideally suited for high-end ATEX applications in the higher temperature range for a range of applications, including medical technology. The company says that in the past it has been difficult to develop certain industrial applications for transparent polyamides due to their inadequate high-temperature resistance. However, Trogamid HT has a glass transition temperature of 172°C, which is 30°C above that for comparable Trogamid products and therefore ensures high heat resistance. A water uptake of

lower than 2% provides good dimensional stability and the low density of 0.98g/cm³ helps save weight. The material also offers good chemical resistance, high static and dynamic load capacity and wear resistance, high impact resistance, good weathering resistance and scratch resistance.

SABIC has introduced a new range of PC copolymer resins featuring the chemical resistance needed to enhance the durability and resilience of medical devices and equipment housings. The company says that its copolymer technology can help prevent premature part failure from environmental stress cracking due to increasingly aggressive disinfectants, such as alcohols, peroxides and quaternary ammonium compounds, used to prevent hospital-acquired infections. The new portfolio includes amorphous and semi-crystalline materials that can serve as potential drop-in solutions in existing production tooling.

Udel PSU from **Solvay** has been used by Nordson Medical to develop its Spaulding Series Aseptic Disconnects for pharmaceutical and bioprocessing. Udel P-1700 polysulphone (PSU) was chosen for the new series of bioprocess fittings due to its biocompatibility, transparency, strength and rigidity, broad temperature range and compatibility with gamma radiation (up to 50 kGy) and steam sterilisation. Solvay says that Udel P-1700 PSU readily withstands the required operating temperature range of -40°C to 138°C (-40°F to 280°F), enabling the aseptic disconnects to be used in cryogenic conditions and be steam sterilised. The material's transparency allows processors to observe the flow of liquid through the connectors, and its combination of high heat resistance and hydrolytic stability provide an important stress cracking advantage over PC. Udel P-1700 PSU is animal-derived-component-free, and it meets USP Class IV requirements for biocompatibility. In addition, components can be moulded to tight tolerances with minimal flash and scrap.

Kraiburg TPE has introduced VDI 2017-compliant Thermolast M compounds for TPE/PA composite applications. The company says the MC/AD/PA Thermolast M series are the first thermoplastic elastomers that not only hold certifications for healthcare applications in accordance with EU and FDA standards, but can also be combined directly with polyamides.

According to Kraiburg TPE, as international regulations for medical-grade plastics (MGP) have become stricter, manufacturers of products for medical devices and healthcare are increasingly looking for opportunities to strengthen their competitive edge by solutions that both comply with the

regulations and are aesthetically pleasing. A representative example is the manufacture of multicomponent applications that saves mounting time by combining a hard polymer with a soft-touch TPE using direct injection moulding (without bonding agents). The MGP-compliant TPE compounds that have been available in the market previously do not provide adhesion to polyamides and thus cannot be used for many sophisticated applications.

The compounds of the new TPE series meet the recently adopted VDI 2017 guideline that regulates the criteria for MGP-compliant materials – from basic requirements to formulation consistency and modification management. They comply with the Commission Regulation (EU) No. 10/2011 and the Code of Federal Regulations Title 21 (21CFR) of the US FDA.

The new TPEs also meet the requirements for human compatibility in accordance with the specifications of the ISO 10993-5 and 10993-11 standards. All types can be sterilised using beta or gamma radiation, or ethylene oxide. They also comply RoHS and REACH regulations in the EU.

Kraiburg TPE manufactures the materials exclusively on specially approved production lines. Quality assurance extends through to full traceability of raw materials on the suppliers' side. Types with a hardness range between 60 and 70 Shore A are currently available. The company says they provide smooth and velvety surfaces with a soft touch featuring good resistance to scratches, wear and sebum (lipids secreted to the skin's surface).

Trinseo has launched a range of wear-resistant, high lubricity PC resins highly suited to drug delivery applications. The company says the resins have been designed for drug delivery devices and surgical tools, which are growing in importance for



IMAGE: KRAIBURG TPE

their convenience and cost saving potential. Part of Trinseo's Calibre series, the new material platform provides a solution for the low friction movement of one material over another, extending product life and minimising noise without external lubricants. The company has also developed the Emerge 9000 product portfolio. This product range is used extensively in diagnostic equipment housings to resist the aggressive cleansers and disinfectants used by healthcare professionals to fight healthcare associated infections.

Borealis and **Borouge** have launched a new service solution, Bormed InCompounds, which enables the customisation of compounds based on Bormed for use in an even wider range of targeted healthcare applications and products. Borealis says it collaborates with selected compounders to offer Bormed quality, reliability and conformance in compounds and masterbatches. Each collaborator must have a dedicated healthcare team composed of marketing and business development managers as well as application and regulatory experts; an established healthcare product brand; and ISO 13485-2016. At present, Bormed InCompounds involves close collaboration with long-standing and trusted Borealis partners Clariant, Melitek and Wittenburg.

Above:
Kraiburg TPE
has introduced
VDI 2017-com-
pliant Thermo-
last M com-
pounds for
TPE/PA
composite
applications



IMAGE: SABIC

Above: SABIC has introduced a new range of polycarbonate copolymer resins featuring the chemical resistance needed to enhance the durability and resilience of medical devices and equipment housings

CLICK ON THE LINKS FOR MORE INFORMATION:

- > www.rtpcompany.com
- > www.fostercomp.com
- > www.topas.com
- > www.silicones.elkem.com
- > www.teknorapex.com
- > www.covestro.com
- > www.evonik.com
- > www.sabic.com
- > www.solvay.com
- > www.kraiburg-tpe.com
- > www.trinseo.com
- > www.borealisgroup.com
- > www.borouge.com

NEW DATABASES

**FIND
OUT
MORE**

Plastics Processors in Croatia and Serbia

**Generate business opportunities in new
markets with targeted data for over 300 sites**

Databases also available for Bulgaria,
Czech Republic and Slovakia, Hungary,
Poland, Romania and Slovenia.

CONTACT US

T +44 (0) 117 314 8114

E Sales@ami.international

W bit.ly/PPCEEurope

AMI

Robust research and expert data for the global plastics industry



AMI's Plastics Regulations conference takes place in Cologne in March, covering everything from food contact and chemical regulation through to the single-use plastics directive. We preview the event



IMAGE: SHUTTERSTOCK

Keep in touch with regulation

AMI's fourth Plastics Regulations EU conference takes place on 11-12 March in Cologne, Germany, providing a valuable opportunity to gain focused advice on a range of legal and compliance issues impacting on polymer producers, compounders, processors and end users. Bringing together a wide variety of leading legal experts, the conference presents a cost and time efficient way to future-proof your business by making sure you are aware of changing and developing regulations.

This year's event will be preceded by a standalone pre-conference Brexit workshop that will explain the potential regulatory and trading implications of the UK's departure for UK, EU and non-EU companies. See the box on the following page for more information on the expert speakers and content or click [here](#).

Plastics Regulations 2020 will open with a global regulatory update on the plastics economy, which will be presented by **Peter Sellar**, Partner at **FieldFisher** in Belgium. This will be followed by an overview of international economic sanctions presented by **Siegfried Richter**, Policy Officer at the **European Commission**. Then **Bonita Reynolds**, Senior Director Authoring Services at

Verisk 3E in the US, will speak about the US Toxic Substances Control Act (TSCA) and achieving compliance for plastics.

Recycling issues

It would be difficult to underplay the importance of recycling and waste regulations in today's business environment. **Joachim Quoden**, Lawyer at **Law Firm Joachim Quoden** in Germany, will provide a perspective on the impact of the initiatives and tools being used to build the circular economy. Then **Luke Douglas-Home**, Managing Director of **Clear Public Space** in the UK, will share details of a study highlighting differences in plastic packaging regulations across EU member states (and the UK).

The next session will turn to the topic of REACH. **Marcus Navin-Jones**, a Partner at **Keller and Heckman** in Belgium, will ask whether REACH authorisation is becoming a barrier to recycling and re-use of plastics. **Dr Frank Friedel**, Senior Chemicals and REACH Consultant at **TSG Consulting** in the UK, will give an overview of the Single-Use Plastics Directive and the REACH regulation. And **Filippo Mattioli**, an Associate at **Steptoe & Johnson** in Belgium, will cover

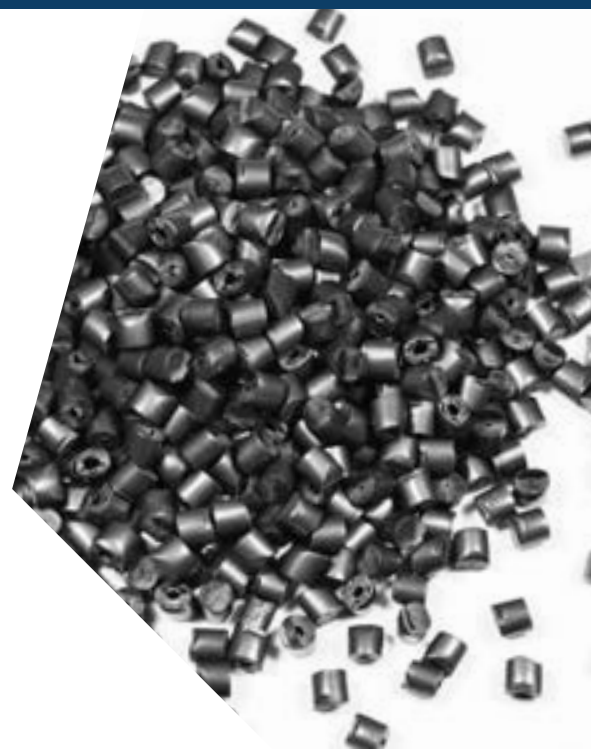
Main image:
AMI's fourth European Plastics Regulations conference will update on food contact, packaging and recycling regulations

Thermoplastic Concentrates NAFTA Opportunities in a changing market

Learn how this market report can help your 2020 strategy:

- Understand how and where the market is growing on an individual end use application basis
- Gain a clear understanding of supply and demand for the medium term
- Develop a real understanding of the strategies required to drive success

FIND OUT MORE



AMI

Robust research and expert data for the masterbatch industry

www.ami.international/cons



SPREAD THE WORD

Media information 2020
Injection WORLD
The global digital magazine and apps for injection moulders

Injection World is the monthly magazine providing business, industry and technology news for injection moulders, masterbatch and product designers around the globe. It is accessed by thousands of readers every month free of charge online, on tablets, smartphones, and via our free apps for the iPad, iPhone and Android devices.

Injection World delivers relevant and up-to-date information on the most important technical developments, market trends, business news, design innovations and legislative announcements. And, unlike other general plastics magazines, it is 100% focused on the specific information needs of designers and producers of plastic mouldings.

Published by our expert editorial team at AMI - the leading provider of databases, market intelligence, conferences and events for the global plastics processing industries - Injection World benefits from access to our detailed databases of senior decision makers at injection moulding sites across Europe, the Americas, Asia and the Middle East. These global databases include key purchasers of injection-moulding machines, moulds, auxiliary equipment, polymers, additives and related services.

Looking to access this market? Our advertisements are very competitively priced and include links directly to your website. If you are selling machinery, auxiliary equipment, materials, additives or services to the injection moulding industry, then Injection World is the ideal platform for you.

Injection World offers:

- ✓ Comprehensive global coverage
- ✓ 100% focused on injection moulding
- ✓ In-depth market knowledge
- ✓ Free access online and via apps
- ✓ Highly competitive advertisement rates
- ✓ Live weblinks from all advertisements
- ✓ App viewable without internet connection

Visit www.injectionworld.com to see the latest issue and take out a free subscription

Target info
Each month of market news and analysis, we are providing you with the most relevant information for your business.

Features list

- November/Dec 2019
 - Automotive - Injection Moulding
 - Engineering plastics
 - Masterbatch reviews
 - K2019 review
- July/August
 - Packaging
 - Culture and media
 - Bioplastics
- September
 - High temperature
 - Materials law
- October
 - Surface and oil
 - Smartphones
 - Plastics 100
 - Composites
 - Recycling
- April
 - Capex and closures
 - Automation and robotics
 - Legal advice column
 - Challenges 2020 preview
- May
 - Automotive - under the hood
 - Thermoplastic elastomers
 - Joining and assembly
 - Compositing World
 - App 2020 first preview

Rates and Data
Injection World's competitive global advertising rates ensure your marketing budget goes much further:

£ - Zone	Single	3m	6m	12m	\$ - Dollars	Single	3m	6m	12m
Europe page spread	£1,200	£3,600	£7,200	£13,800	Double page spread	\$4,500	\$13,500	\$27,000	\$52,500
Page	£1,200	£3,600	£7,200	£13,800	Page	\$4,500	\$13,500	\$27,000	\$52,500
Half page	£600	£1,800	£3,600	£6,900	Half page	\$2,250	\$6,750	\$13,500	\$26,250
Quarter page	£300	£900	£1,800	£3,450	Quarter page	\$1,125	\$3,375	\$6,750	\$13,125

Global email circulation
The AMI magazine portfolio (Worldwide) has a global email circulation of over 25,000. This includes all AMI magazines and their associated newsletters. The AMI magazine portfolio is available in 10 languages and is accessible via our website and our mobile apps.

Global app downloads
The AMI magazine portfolio is available on the App Store and Google Play. The AMI magazine portfolio has over 25,000 downloads across all platforms.

AMI
AMI is the leading provider of databases, market intelligence, conferences and events for the global plastics processing industries.

Global circulation: 25,396
App downloads: 23,988
Twitter followers: 20,100

AMI - Bringing the plastics industry together
Injection World magazine is published monthly by AMI - the leading provider of databases, market intelligence, conferences and events for the global plastics processing industries. Injection World magazine is available in 10 languages and is accessible via our website and our mobile apps.

COMPOUNDOING
Injection World magazine is published monthly by AMI - the leading provider of databases, market intelligence, conferences and events for the global plastics processing industries.

Let the world know about the good things your company is doing by advertising in *Injection World* magazine. Download the media pack to find out about our forthcoming features, global readership, and cost-effective advertisement packages.

CLICK HERE TO DOWNLOAD

microplastics and the moves towards REACH restriction.

The final session of the first day looks at sustainability issues. It will be opened by **Dr Gary Ogden**, Technical Manager at **Wells Plastics** in the UK, who will discuss regulations and standards covering oxo-degradable plastics. Regulations applicable to plant-based additives for plastic food contact materials will be explored by **Job Ridderbecks**, Food Contact Technical Specialist at **Intertek** in Germany. Then **Ines Zitterbart**, Senior Regulatory Consultant at **Yordas Group** in Germany will bring the day to a close with an explanation of the challenges and misconceptions relating to biodegradable plastics.

Expert discussions

The second day of Plastics Regulations will open with a panel discussion exploring the outcome of the EU framework review and the implications it holds for the plastics industry. Expert participants will include: **Marcel Bosma**, Regulatory Expert at **SABIC** in the Netherlands; **Dr Peter Oldring**, Manager Regulatory Affairs - Europe at **Sherwin Williams** in the UK; and **Dr Anna Gergely**, Director EHS Regulatory at **Steptoe & Johnson** in Belgium.

The conference then turns to discuss the challenging topic of non-intentionally added substances (NIAS). **Dr Stamatios Stamenitis**, Senior Principal Scientist SRA at **Mars** in Germany, will open the session with an overview of what is happening in Europe in this area. NIAS testing, database implementation and post-run evaluations will be detailed by **Dr Marinella Vitulli**, Technical and General Manager at the **Food Contact Center** in Italy. And **Dr Christian Kirchnawy**, Team Leader at the **OFI Austrian Research Institute** will talk through safety assessment of food contact materials, including the value and limitations of in-vitro bioassays.

Registration of food contact resins and additives in China will be covered by **Ran Liu**, Regulatory Consultant at **CIRS Group** in Ireland. Then **Dr Ralph Derra**, Managing Director of **ISEGA** in Germany, will share some new developments in test methods for plastics in contact with food.

The final session of Plastics Regulations 2020 looks at regulation of specific additives. **Alfred Voskian** and **Jytte Syska**, both Consultants at **Syska Voskian Consulting** and based in the US and Denmark respectively, will outline the current state of play on pigments used in plastics. And **Mark Carpels**, Environment Product safety and CSR at **Campine** in Belgium, will discuss the impact of REACH on antimony and other metals.

Brexit – find out what it will mean for you



The UK's departure from the EU will have far-reaching consequences for many companies. And those consequences are not restricted to EU and UK firms; they will also affect companies from outside the EU that have, until now, used a UK subsidiary or representative to access the European market.

With this in mind, AMI has assembled a special one-day Brexit Workshop that will highlight the legal implications of Brexit and their potential impact on businesses trading from or to the EU, UK and other global locations. Taking place one day before Plastics Regulations 2020 on 10 March 2020, the event will be run by three experts on international trade and regulation: **Paul Ashford**, Managing Director of **Anthesis-Caleb** in the UK; **Simon Tilling**, Partner at **Burges Salmon** in the UK; **Dr Anna Gergely**, Director EHS Regulatory at **Steptoe & Johnson** in Belgium.

Each host will run a session looking at the impact of Brexit from different perspectives, allowing attendees to build a picture of the potential risks it entails and to formulate a readiness strategy. The workshop will be broken up with round table discussion periods moderated by the workshop hosts.

Find out more and book your place [here](#).

Learn about Plastics Regulations 2020

AMI's fourth Plastics Regulations Europe takes place on 11-12 March 2020 at the Pullman Cologne Hotel in Cologne, Germany. It will be preceded by a special one-day Brexit Workshop on 10 March 2020 (see the box above or click [here](#)).

The conference will bring together a selection of expert speakers to detail the latest regulatory developments impacting on the plastics industry, from chemicals and food contact through to recycling and single-use packaging. Aside from the formal presentations, it will provide extensive networking opportunities during the break-out sessions and complimentary cocktail reception.

To find out more, contact the conference organiser, Emily Nicholson. Email: emily.nicholson@ami.international Tel: +44 (0) 117 314 8111. Or visit the [conference website](#)



Plastics Regulations 2020 is CPD accredited and will count as 11.5 hours towards your CPD record.

The CPD Standards Office
CPD PROVIDER: 41162
2019-2020
www.cpdstandards.com



Download these new product brochures

Simply click on the brochure cover or link to download a PDF to your PC or smartphone

SOLVAY: TECHNYL 4EARTH



Technyl 4earth is a polyamide 6.6 made from post-industrial technical textiles which is able to offer mechanical performances similar to traditional Technyl materials while providing breakthrough environmental benefits.

[CLICK HERE TO DOWNLOAD](#)

POLYKEMI: CUSTOM COMPOUNDS



This 12-page brochure provides an introduction to Polykemi and its range of custom engineered plastic compounds. It includes details of production locations, subsidiaries, R&D capabilities and quality certifications.

[CLICK HERE TO DOWNLOAD](#)

HEXPOL: DRYFLEX TPES



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

[CLICK HERE TO DOWNLOAD](#)

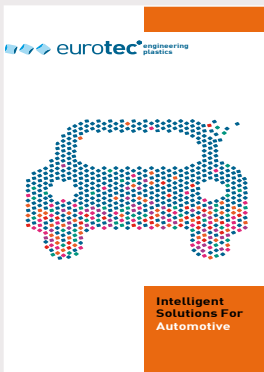
BOY: PROCAN ALPHA 4



Procan Alpha 4 is the new machine control from BOY with a fast and intuitive touchscreen operation. A more powerful CPU allows a 50% improvement in screen refresh times. Read more about Procan Alpha 4 in this brochure.

[CLICK HERE TO DOWNLOAD](#)

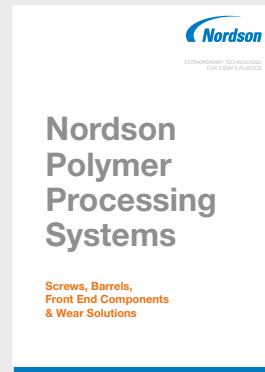
EUROTEC: AUTOMOTIVE COMPOUNDS



This brochure presents the full range of Eurotec's engineering polymer compounds for automotive applications, including interior, exterior and under the hood. Read all about Eurotec's innovative products and tailor made services.

[CLICK HERE TO DOWNLOAD](#)

NORDSON PROCESSING SYSTEMS



The plasticising components offered by Nordson for injection moulding include bi-metallic barrels, screws and FECs, as well as barrel coatings and wear solutions. Find out more in this brochure.

[CLICK HERE TO DOWNLOAD](#)

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

Optimise your industry knowledge with AMI's recommended databases

Injection Moulders in Italy



Get a key insight into the fragmented Italian market with managerial contact names, polymer consumption, market and machinery data for 1128 sites. Identify companies of interest for your business by receiving an updated overview on their production activities.

[CLICK HERE](#)

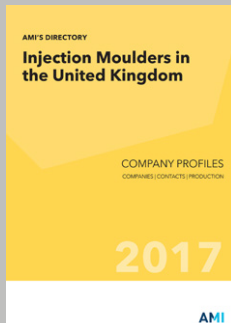
Injection Moulders in France



Get an updated picture on the injection moulding industry in France with instant access to 884 production sites. Get managerial contact names, polymer consumption, market and machinery data for each site. Access manufacturers supplying plastic products to the automotive, medical, building and packaging sectors amongst others.

[CLICK HERE](#)

Injection Moulders in the United Kingdom



A complete and up-to-date picture of the injection moulding industry in the United Kingdom. Find out the polymers processed, the products manufactured and the number and size of machines operated by 904 injection moulding sites in the United Kingdom.

[CLICK HERE](#)

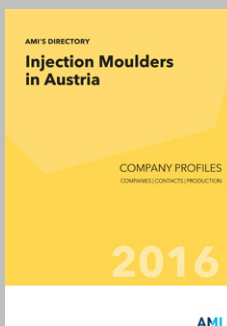
Injection Moulders in Spain and Portugal



A unique insight into the production of 1011 injection moulders in the Iberian peninsula. This directory gives you access to managerial contacts and production information on 790 manufacturing sites in Spain and 221 in Portugal serving a number of markets such as medical, automotive, electronics as well as food and non-food packaging.

[CLICK HERE](#)

Injection Moulders in Austria



This directory identifies 189 injection moulders in Austria serving the electronic and electrical markets as well as other industry segments. The data is available in pdf format or as a database which enables you to search companies by polymers processed, markets served or number and make of machines operated.

[CLICK HERE](#)

Injection Moulders in Germany



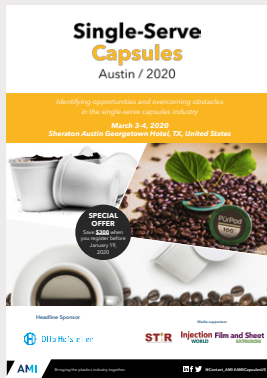
Germany is the leading country for injection moulding in Europe. Gain access to this market with profiles of 2162 injection moulding sites in Germany. Access in-depth contact and production data equipped with extensive search capabilities. Alternatively, the pdf version supplies basic company profiles.

[CLICK HERE](#)

Learn more about AMI's upcoming conferences

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

SINGLE-SERVE CAPSULES USA



The 3rd edition of AMI's international Single-Serve Capsules conference in North America, on March 3-4, 2020 in Austin, Texas, brings together industry-elite speakers to evaluate and discuss the trends, challenges and opportunities facing the sector.

[CLICK HERE TO DOWNLOAD](#)

LSR INNOVATIONS



AMI's LSR Innovations conference returns to Neuss, near Düsseldorf, in Germany on 4-5 March 2020. The event brings together materials and processing technology experts, processors and end-users to explore the latest LSR solutions and trends.

[CLICK HERE TO DOWNLOAD](#)

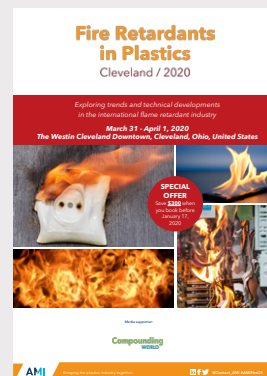
PLASTICS REGULATIONS EU



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

[CLICK HERE TO DOWNLOAD](#)

FIRE RETARDANTS IN PLASTICS



The 10th edition of AMI's Fire Retardants in Plastics conference moves to Cleveland, Ohio, USA. Taking place on 31 March-1 April, the event explores the regulatory and technical developments shaping the North American fire retardants market.

[CLICK HERE TO DOWNLOAD](#)

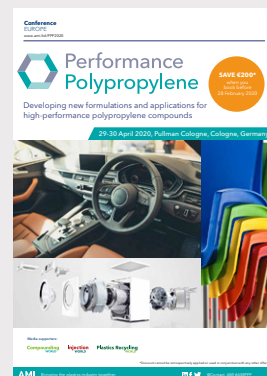
POLYMERS IN FOOTWEAR USA



The second edition of AMI's North American Polymers in Footwear conference takes place in Portland, OR, USA, on 7-8 April 2020, presenting a comprehensive analysis of the latest advances in footwear materials and processing technologies.

[CLICK HERE TO DOWNLOAD](#)

PERFORMANCE POLYPROPYLENE EU



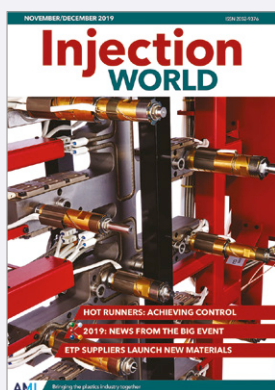
The third edition of AMI's European Performance Polypropylene conference comes to Cologne in Germany on 29-30 April. Learn more about the use of this versatile polymer in demanding markets such as automotive appliances and construction.

[CLICK HERE TO DOWNLOAD](#)

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

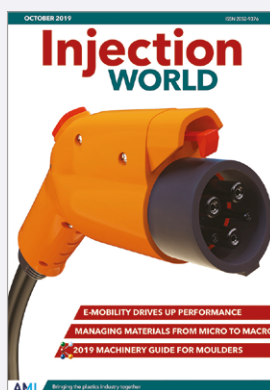
Keep informed: read our latest editions

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



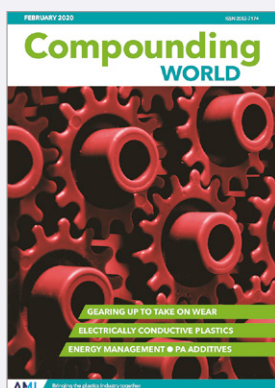
Injection World
November/December 2019
The November/December edition of Injection World takes explores new developments in hot runners and engineering thermoplastics. It also examines some of the latest automotive applications and details innovations on show at K2019.

[▶ CLICK HERE TO VIEW](#)



Injection World
October 2019
The October issue of Injection World magazine covers new resins and compounds developed for new electro-mobility applications. Feature articles also take a look at what's new in materials handling and product development with 3D printing.

[▶ CLICK HERE TO VIEW](#)



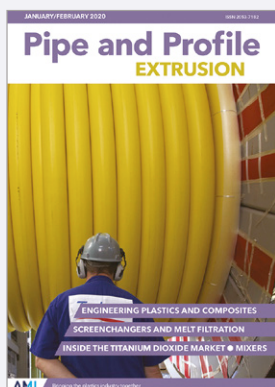
Compounding World
February 2020
The February edition of Compounding World includes features on wear-resistant materials, energy efficiency, electrically conductive plastics and a look at new demands on polyamides from applications in e-mobility and high powered electrical connectors.

[▶ CLICK HERE TO VIEW](#)



Plastics Recycling World
January/February 2020
The January-February of Plastics Recycling World takes a deep dive into chemical recycling, with features on the many technologies being developed for polyolefins and polystyrene. Plus the latest on film recycling technology and projects.

[▶ CLICK HERE TO VIEW](#)



Pipe and Profile
January/February 2020
The January-February issue of Pipe and Profile Extrusion looks at applications using engineering plastics and composites, provides updates on mixing technology and melt filtration and delves into the titanium dioxide market.

[▶ CLICK HERE TO VIEW](#)



Film and Sheet
January/February 2020
The combined January/February edition of Film and Sheet Extrusion examines the latest developments in film technology, plus new polymer analysis equipment and some innovative medical materials and applications.

[▶ CLICK HERE TO VIEW](#)

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

Compounding
WORLD

Film and Sheet
EXTRUSION

Pipe and Profile
EXTRUSION

Injection
WORLD

Plastics Recycling
WORLD

GLOBAL EXHIBITION GUIDE

2020	3-5 March	JEC World, Paris, France	www.jec-world.events
	9-11 March	Plast Alger, Algiers, Algeria	www.plastalger.com
	11-12 March	PlastExpo Nordic, Helsinki, Finland	www.plastexpo.fi
	11-13 March	Expo Plasticos, Guadalajara, Mexico	www.expoplasticos.com.mx
	21-24 April	Chinaplas – POSTPONED	www.chinaplasonline.com
	7-13 May	Interpack, Dusseldorf, Germany	www.interpack.com
	19-22 May	Plastpol, Kielce, Poland	www.targikielce.pl
	3-4 June	Compounding World Expo Europe, Essen, Germany	www.compoundingworldexpo.com/eu/
	8-11 June	Argenplas, Buenos Aires, Argentina	www.argenplas.com.ar
	29 Sep-1 Oct	Interplas, Birmingham, UK	www.interplasuk.com
	13-17 October	Fakuma, Friedrichshafen, Germany	www.fakuma-messe.de
	4-5 November	Compounding World Expo USA, Cleveland, USA	www.compoundingworldexpo.com/na/
	8-11 November	Pack Expo, Chicago, USA	www.packexpointernational.com
2021	23-26 November	All4Pack, Paris, France	www.all4pack.com
	2-4 December	Plastic Expo, Tokyo, Japan	www.plas.jp/en-gb.html
	4-7 May	Plast 2021, Milan, Italy	www.plastonline.org/en
	17-21 May	NPE 2021	www.npe.org

AMI CONFERENCES

4-5 March 2020	LSR Innovations, Dusseldorf, Germany
10 -12 March 2020	Plastics Regulations, Cologne, Germany
31 March-1 April	Fire Retardants in Plastics, Cleveland, OH, US
7-8 April 2020	Polymers in Footwear, Portland, OR, US
29-30 April 2020	Performance Polypropylene, Cologne, Germany
5-6 May 2020	Performance Polyamides, Detroit, MI, US
12-14 May 2020	Polymer Sourcing & Distribution, Hamburg, Germany

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

PLASTICS RECYCLING
WORLD EXPO

POLYMER TESTING
WORLD EXPO

3 - 4 June, 2020
ESSEN, GERMANY

PLASTICS EXTRUSION
WORLD EXPO

COMPOUNDING
WORLD EXPO

4 - 5 November, 2020
CLEVELAND, OHIO

www.ami.international/exhibitions