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CONTACT US

AMI

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

Fax: +44 (0)117 311 1534

www.ami.international

www.twitter.com/plasticsworld

Registered in England No: 2140318

EDITORIAL

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

Editor: David Eldridge
david.eldridge@ami.international

Technology editor: Peter Mapleston
editorial@injectionworld.com

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

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ADVERTISING

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

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

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

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

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RPC in the spotlight as Apollo bids

Private equity firm Apollo Global Management has agreed to buy UK-based RPC Group, the rigid and flexible packaging company, for £3.3m through a newly formed subsidiary. The week after the deal was announced, US packaging giant Berry Global said it was also considering a cash offer for RPC Group to rival the Apollo bid.

The £7.82/share offer from Apollo represents a 15.6% premium on the company's share price on the last day before the offer began. RPC chairman Jamie Pike and the board of directors said they believed the terms to be "fair and reasonable" and will



RPC agreed a new three-year rigid packaging supply deal with Norwegian dairy group TINE in January

recommend that shareholders accept. Pike reiterated that in July 2018 he had said that "differing investor views on the appropriate level of gearing was constraining the group's ability to pursue opportunities for growth and, as such, putting pressure on RPC's valuation". This, he added, was the

culmination of the process the board had started to resolve the situation.

"It is not all that surprising to see another UK PLC disappear from the public market in this manner," said Nicholas Mockett, head of packaging M&A at Moorgate Capital in the UK. "RPC had fallen out of favour with

the financial community due to its high-profile M&A programme. At the same time, media hysteria was rife against plastic."

RPC had been in negotiations with Apollo and another potential bidder, Bain Capital, since 2018. Bain pulled out ahead of the December deadline, though this had to be extended three times before Apollo finally made its offer. Apollo previously owned the US-based Berry Global and has had many other investments in chemicals down the years. In early February, it was reported RPC management would have talks with Berry about its potential offer.

➤ www.rpc-group.com

Patrimonium takes stake in Hübner

Patrimonium Private Equity, a division of Switzerland's Patrimonium Asset Management, has acquired a majority stake in C. Hübner, which specialises in surface technology. Hübner employs over 200 people in tool making, plastic injection moulding and plastic electroplating at three sites in Marktobendorf, Bavaria. It mainly supplies the sanitary, automotive and consumer products markets.

Thomas Hübner, the third-generation manager of the family-owned firm, will remain MD.

➤ www.patrimonium.ch

Hella in car lighting partnerships

Hella, the German supplier of lighting technology and electronic products for the automotive sector, has formed two partnerships with Tier 1 suppliers: one with Plastic Omnium on integrated car body lighting and the other with Faurecia for the development of interior lighting systems. Terms were not disclosed in either case.

The collaboration with Plastic Omnium will involve engineering and design experts from both companies, and will be based in Germany. The focus will be on new systems integrating innovative lighting technologies, and intelligent exterior systems, at the front and at the rear of the car, including "smart bumpers and tailgates, enriched with

communication and lighting features", according to Laurent Burelle, chairman and CEO of Plastic Omnium.

Faurecia's and Hella's strategic partnership will jointly develop "lighting with high-technology content in the domain of surface-lighting and dynamic-lighting for a more personalised cockpit environment", as trends like

autonomous driving and individualisation redefine vehicle interiors. The two companies had already showcased what they called "a unique ambient lighting experience for a more comfortable, dynamic and versatile environment integrated into a cockpit of the future" at the Paris Motor Show in October 2018.

➤ www.hella.com



Hella and Faurecia are already collaborating on car interiors

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Over 200 exhibitors join Cleveland plastics shows

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

Organised by AMI, the Plastics Extrusion World, Plastics Recycling World, and Compounding World Expos will feature a wide range of processing machinery, auxiliary equipment, polymer materials, additives and related services.

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

The 200+ companies that have already booked booths include: Alpha Marathon, Addex, Advanced Blending Solutions, BASF, Brabender, Buhler,



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

Buss, BYK, Cabot, Chemours, Clariant, Cloeren, Colines, Coperion, Cumberland, Davis-Standard, Dover Chemicals, Dr Collin, Entek, Erema, Exxel Polymers, Farrel Pomini, Ferro, Gneuss, Greiner Extrusion, Heritage Plastics, JSW, Konica Minolta, KraussMaffei Berstorff, Kuhne, Leistritz, Lubrizol, Maag, Maguire, Matsui, Milliken, NFM, Nordson, Oden Technologies, Omya, Pall, Parkinson Technologies, PSI-Polymer Systems, Reifenhauer, SI Group, Starlinger, Struktol, Vecoplan, Wacker, Zoltek, and over 150 more suppliers from around the world.

The limited number of remaining

booths are being filled on a daily basis. Prices start at \$3,400 for a 100 sqft booth. To find out more about exhibiting at any of the expos, visit <https://www.ami.international/exhibitions>.

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

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> [ami.ltd/Register-AMI-Expos](https://www.ami.international/exhibitions)

Freudenberg Medical expands with new HQ



Freudenberg device development

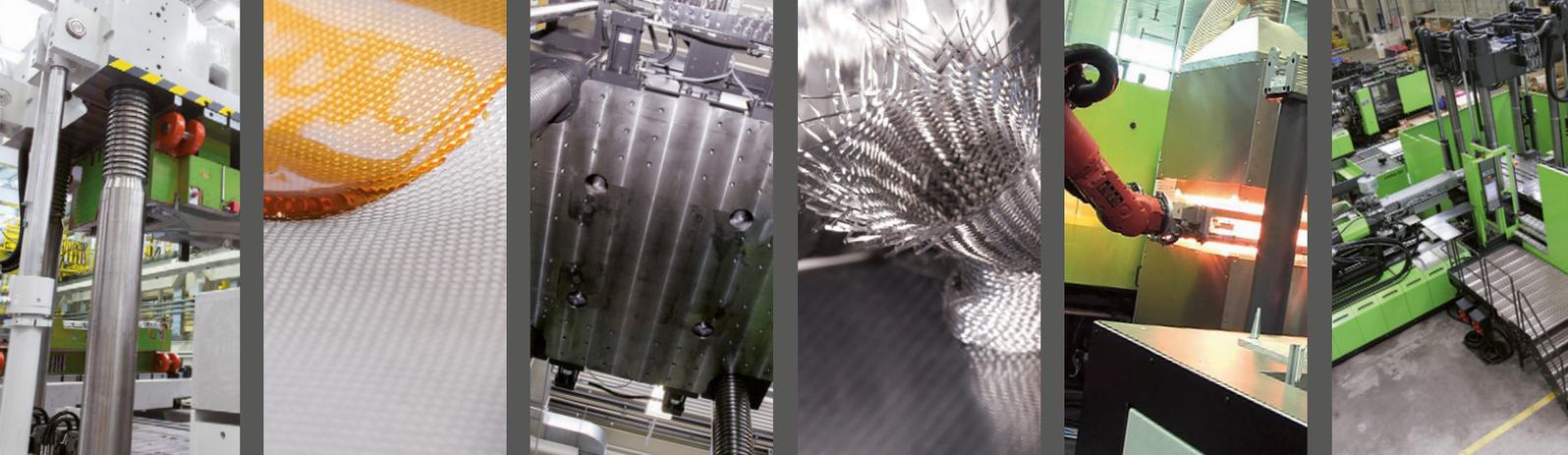
Freudenberg Medical has announced plans to build a new medical manufacturing facility at Beverly, just north of Boston, in Massachusetts, US, which will also be its global HQ. It will relocate operations from nearby Gloucester, where it has made medical components and devices since 1989, and will expand the operation.

The company said that it will invest over \$3m at the site, which will cover 3,350 m², with potentially 1,860 m² more for future expansions. The facility will be FDA-registered and ISO

13485-certified with ISO Class 8 cleanrooms for medical moulding and assembly. It should be operational in the second half of 2019, employing about 70 people.

"Our decision to expand here is a testament to the strong growth of Freudenberg Medical in this region and locating our global headquarters in Beverly demonstrates the global role and international orientation of the Boston medical device cluster," said Max Kley, President and CEO of Freudenberg Medical.

> www.freudenbergmedical.com



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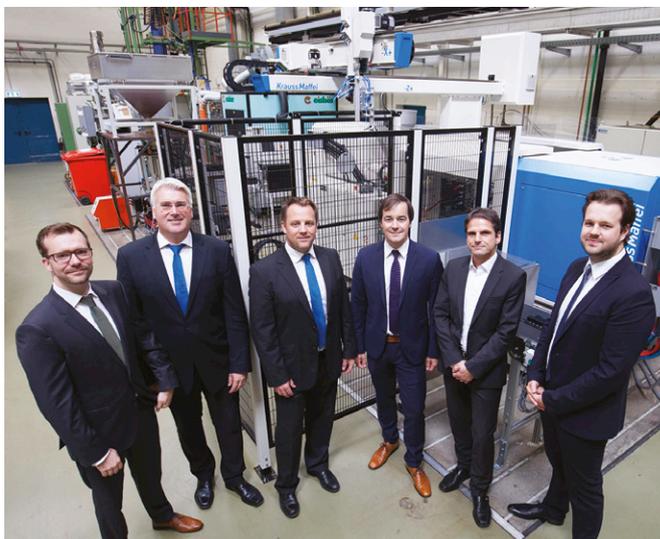
www.engelglobal.com

KraussMaffei gains from listing in China

The KraussMaffei Group has completed its listing on the Shanghai stock exchange and is moving forward with its plans in China, which include manufacturing injection moulding machines there for the local market.

As part of the share listing, KraussMaffei's majority owner ChemChina transferred its stake to a listed subsidiary, Qingdao Tianhua Institute of Chemistry Engineering (THY). This will give KraussMaffei full access to the Chinese capital markets. THY has taken over ChemChina's production site in Sanming.

"With the additional production site in Sanming, we can further expand our presence in China. At the same time, we will drive our international business from Germany," said Frank Stieler, CEO of KraussMaffei. He added that access to the Chinese capital market will contribute to the company's 'Compass' strategy to expand its business models, especially in digital services. In July 2018, KraussMaffei



In January, KraussMaffei executives visited the University of Duisburg-Essen in Germany for the handover of a PX 120-380 injection moulding machine to the plastics engineering faculty

launched its Digital Service Solutions business unit for this purpose.

KraussMaffei will still be based in Munich, with German co-determination rights and no change to its legal status or employee and union agreements. The rights to technologies also remain bundled in Germany.

The group also announced plans to relocate its main plant and corporate HQ from Munich's Allach

district to Parsdorf/Vatterstetten, just east of the city, starting in 2022. Four new factory halls, a tech centre and two office buildings will be built, occupying a total area of 250,000 m². KraussMaffei said it will follow a "smart factory concept" which it expects will achieve "a substantial increase in productivity through digitalisation and state-of-the-art logistics".

› www.kraussmaffei.com

Sweden's KB buys in Canada

As a part of the reconstruction of the Vari-Form Group, Sweden's KB Components has acquired the assets of PM Plastics based in Windsor, Canada, and renamed it KB Components Canada. The new entity will have sales of \$10m per year from a facility with 20 injection moulding machines of up to 500 tonnes. KB Components already serves one of the site's major customers, Kautex, in China and Mexico.

"A global presence is a necessity for many of our customers and through the establishment of KB Components Canada, we will offer production in Sweden, Lithuania, Slovakia, China, Mexico and Canada," said company president Stefan Andersson. For PM Plastics' customers, he added, this will create access to increased R&D, production capacity and technological know-how.

› www.kbcomponents.com



Dri-Air expands US manufacturing

Ancillary equipment group Dri-Air Industries has announced a "significant addition" to its main facility at East Windsor, Connecticut, US. This will increase manufacturing and warehousing capacity by about 50% and will "allow us to stock larger hoppers and components for our fastest growing segment, our large dryer market," said president Jason Sears. It will also boost the company's ability to integrate manufacturing of all dryer

parts in one facility for faster lead times.

Dri-Air mainly supplies dryers for custom drying and conveying systems, which are used by plastic injection and extrusion processors. The company's recent growth has been driven by the need for manufacturers to reduce energy use, which is offered by its closed-loop temperature-based regeneration process.

› www.dri-air.com

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MB buys another BiPower

MB Spritzgusstechnik of Marktoberdorf, Germany, has installed a second Negri Bossi BiPower VH2700-56000, a two-platen machine with 27,000 kN clamping force and injection capacity of 28 kg of HDPE. MB has been in operation for 15 years and has 30 machines. It converts recycled plastics into industrial pallets.

The new machine features servo electric screw rotation and a special screw profile for complex recycled materials, with complete Sytrama automation and a Kuka six-axis robot. The injection unit, according to Negri Bossi, is designed so that a uniform melting and homogenising of the recycled material is possible.

➤ www.negribossi.com

Total Corbion starts up PLA plant in Thailand

Total Corbion announced the start-up of its 55,000 tpa PLA bioplastic plant at Rayong in Thailand in December. The move makes the company the world's second largest player in PLA after US-based Natureworks.

The facility will produce a full range of PLA resins, which will be sold under the Luminy name, including standard and high heat resistant grades. It is integrated with a 100,000 tpa plant producing lactides from locally-grown sugar cane and is located on the same site as Total-Corbion's 1,000 tpa pilot plant, which will provide a product development capability.

"The start-up of this state-of-the-art plant establishes Total Corbion as a world-scale PLA bioplastics producer ideally located to serve growing markets from Asia Pacific to Europe



Total Corbion's PLA plant in Thailand is now in operation

and the Americas. The subsequent increase in global PLA capacity will enable manufacturers and brand owners to move into the circular economy and produce bio-based products with lower carbon footprints," said Total Corbion CEO Stephane Dion.

➤ www.total-corbion.com

■ In a separate move, process equipment producers Futero, Sulzer and TechnipFMC have announced the formation of a

new partnership to offer turnkey plant for production of PLA bioplastics. The PLANet partnership is intended to support construction of plant with a throughput of up to 100,000 tpa. It brings together Futero's proprietary technology for production of lactic acid and raw lactides, Sulzer's lactide purification and polymerisation know-how, and TechnipFMC's plant design and engineering skills.

➤ www.lactic.com

EuPC survey shows recyclate quality concerns

Converters are looking for consistency in recyclate

Most European plastics converters (76%) believe that improved collection and sorting of plastic waste would be the most suitable way to increase the quality of

recycled plastic materials, according to the second survey carried out by the European Plastics Converters Association (EuPC).

They also said that they saw investments in better recycling technologies by recyclers (53%) and better design for recycling

(29%) as important measures.

EuPC said an increase in the volumes of recyclate being incorporated into new products, as envisioned in the Plastics Strategy, "is practically impossible under the current conditions", because the supply is only adequate for two of the polymers included in the survey. In quality terms, only PET supplies are good enough, they added.

The EuPC carried out the survey in the first nine months of 2018 in partnership with Polymer Comply Europe, with 376

converters from 21 countries completing the online questionnaire. It is described as part of the association's ongoing work to address the technical issues related to the recycling of polymers and the use of recyclate by converters.

A third survey will take place this year. The EuPC is also currently working on a project to develop a single, unified online tool to monitor the use of recycled material in the European plastics converting industry.

➤ www.pceu.eu



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Westfall Technik buys two more firms

Acquisitive US injection moulding group Westfall Technik has continued its buying spree in the past two months. In December, it acquired Mold Hotrunner Solutions (MHS), the supplier of high-performance melt delivery systems with operations in Canada and Germany. In January, Westfall also acquired Mold Craft, which makes precision injection moulds for micro-moulding and high cavitation applications, at its facility in Willernie, MN, US.

The company said that this "further strengthens the comprehensive manufacturing capabilities" it is putting together. Westfall was formed in 2017 when it bought Fairway Injection Molds and Integrity Mold in the US.

MHS specialises in valve

gate hot runner technology for precision plastic parts, from the smallest sizes to shot weights of over 180 kg. It recently introduced a new series of injection moulding machines called M3, with patented technology to make micro-sized plastic parts without scrap, thus cutting costs when using expensive resins in medical device production.

"The M3 really caught our attention at NPE 2018,"

said Westfall CEO Brian Jones. "Keeping ahead of critical industry needs, such as miniaturisation, is very important in our business. Also, the next generation valve gate technology MHS offers for high-cavitation systems and other high-end moulds is in a class of its own, outperforming anything that's out there."

> www.westfall-technik.com

Westfall said the MHS M3 micro-moulding machine caught its attention at NPE 2018



US-Swiss toolmaker tie-up

Accede Mould & Tool in the US and Kebo, based in Switzerland, have agreed to a cooperation partnership, providing their respective customers responsive regional service capabilities in North America and Europe.

Accede offers tooling and turnkey services mainly for the consumer packaging and medical and labware markets. Its core competencies are high cavitation two-shot, stack and SpinStack technology. Kebo makes moulds for high-output production in the medical, pharmaceutical, laboratory and cosmetics industries, plus thin-wall packaging, in-mould labelling and closures.

> www.accedemold.com

> www.kebo.com

Sumitomo (SHI) Demag makes changes



Shoichi Ohira

Shoichi Ohira has been named chief operation officer and head of production at injection moulding machinery maker Sumitomo (SHI) Demag. Chief collaboration officer Hideki Kuroiwa is returning to Japan to head global planning and coordinating future joint projects in the group. This follows on from a strategic alignment of its management structure and expansion of its management team late last year, which included Kuroiwa's appointment.

Ohira, a certified production expert, had established himself as an injection moulding machine expert with the Japanese parent company Sumitomo Heavy Industries, rising to be head of production and quality

management. His task in Europe, said Sumitomo (SHI) Demag CEO Gerd Liebig, will be to "follow through with the already initiated investments in our facilities in Schwaig, Wiehe and Ningbo".

In November, the company revealed that it had appointed a new member of the management team, Martin Fischer, as responsible for operations, including production and purchasing, with effect from 1 October. At the same time, Paolo Zirondoli was named general manager of sales, Liebig took charge of engineering and quality management and Dieter Schuster was named head of quality management.

> www.sumitomo-shi-demag.eu

Producer alliance to invest \$1.5bn to end plastic waste

Some 30 major companies from the plastics and consumer goods value chain have joined to found a not-for-profit global alliance "to advance solutions that reduce and eliminate plastic waste in the environment, especially in the ocean". The Alliance to End Plastic Waste (AEPW) has committed over \$1bn and aims to invest \$1.5bn over the next five years.

The AEPW's founding members are: BASF, Berry Global, Braskem, Chevron Phillips Chemical, Clariant, Covestro, CP Group, Dow, DSM, ExxonMobil, Formosa Plastics, Henkel, LyondellBasell, Mitsubishi Chemical, Mitsui Chemicals, Nova Chemicals, Oxy-Chem, PolyOne, Procter & Gamble, Reliance Industries, Sabic, Sasol, Shell,

Suez, SCG Chemicals, Sumitomo Chemical, Total, Veolia and Versalis.

David Taylor, CEO of Procter & Gamble has been named chairman. He commented that this "is the most comprehensive effort to date to end plastic waste in the environment". The association aims to develop and scale new means to minimise and manage plastic waste, including promoting the recovery of plastics to help create a circular economy. Four key areas for projects will be:

Infrastructure development to collect and manage waste and increase recycling;

Advancing and scaling up new technologies that make recycling and recovering plastics easier and create

value from them post-use;

Education and engagement with governments, businesses and communities to mobilise action; and

Clean-up of concentrated areas of plastic waste, particularly the ten rivers in Asia and Africa, that carry the majority of it to the ocean.

The AEPW said that it will also work with governments, intergovernmental organisations, academia, NGOs and civil society to invest in joint projects to eliminate plastic waste from the environment. However, some NGOs are highly sceptical of an alliance dominated by plastics producers and environmental group Greenpeace has criticised the level of investment as inadequate.

> www.endplasticwaste.org

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Consolidation in capsules

AMI Consulting's Martyna Fong highlights developments analysed in a new report on single-serve capsules, and opposite PTI reviews technical requirements

Single-serve capsules are a dynamic market segment with a complex value chain. The rigid capsules (metal and plastic) market is estimated at 60 billion units in 2018. While rigid capsules are conventionally associated with metal formats, the popularity of plastic alternatives means they have largely overtaken the metal ones.

There are several coffee brewing systems available with proprietary capsule designs. Nespresso and Keurig are brands that pioneered the segment and have the highest machine instalment rates globally. Nevertheless, the expiration of their design patents in 2012 brought about disruptive changes in the supply chain. The changes created new opportunities for both end-users and converters to tap into this growing market segment.

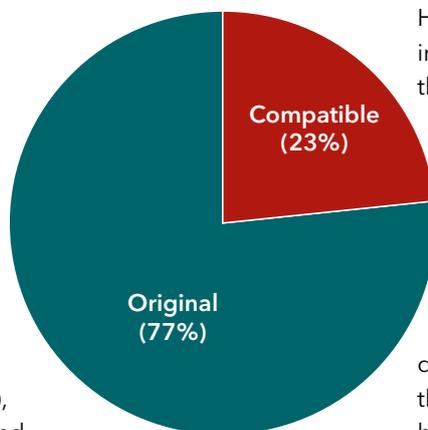
In addition, the supply chain of capsules is rapidly losing its oligopolistic nature and the former dominance of major suppliers is challenged as the market expands. A more fragmented supply chain affects the

overall profit pool and the way consumers make their choices.

Market reach, new channels and increased efficiencies have led to heightened M&A activity in the segment. In this context, Douwe Egberts merged with Jacobs (JDE), JAB took over both JDE and Keurig, Keurig merged with Dr. Pepper Snapple Group, Nestlé struck a deal with Starbucks and Blue Bottle coffee, Coca-Cola took over Costa Coffee, Lavazza bought Carte Noire from JDE and now there are rumours of their potential merger. The industry is likely to consolidate further, which will lead to withdrawal of some capsule systems in favour of others.

AMI Consulting estimates the volume of all compatible capsules (both plastic and aluminium variants) in 2018 is equivalent to 23% of the single serve capsules market worldwide, driven by Nespresso, K-Cup and Nescafé Dolce Gusto machine penetration in households. There are around 200 Nespresso-compatible plastic capsule

Figure 1: Penetration of compatibles



designs, but only 10% of them are said to be able to deliver on quality.

Nespresso is changing elements in the machine design cyclically, and the compatibles suppliers are forced to play catch-up. Anti-trust rules dictate that Nestlé makes design adjustments public with a lead time of six months to allow fair competition.

Compatible single-serve capsules have now become fully embraced by consumers. They are accepted as good-quality alternatives. Mainstream commercialisation of compatible brands has leveraged their need to differentiate and add value. Quality and shelf impact dictate high barrier specification for capsules. Compatibles formerly made

with mono-layer PP and PBT are now being re-specified. High barrier technologies include: co-extrusion thermoforming, co-injection, barrier IML, barrier coatings and barrier compression moulding.

Thermoformed single-serve capsules account for nearly 70% of global plastic capsules demand. The bias towards thermoformed formats has been created with the interlinked success of such systems as Keurig K-Cups in North America and Nescafé Dolce Gusto in Europe. The share of injection moulded capsules has grown versus thermoformed capsules, driven by "value" capsules (low oxygen barrier) that are compatible with Nespresso machines. This type of capsule is relatively easy to produce and the investment in the injection mould can be easily amortised with quick returns. Barriers for market entry for moulders are much lower than for producers of thermoformed capsules with integrated extrusion. Additionally, compression moulding technology was recently commercialised for the production of capsules and is gaining strong supporters in the industry.

There is an urgent need to review the materials used for capsules production in search of more sustainable options.

Compostable capsules are gaining market presence following development of materials and technologies.

Single-Serve Capsules report and events

A new report from AMI Consulting, in cooperation with Plastic Technologies Inc, is an authoritative and comprehensive deep-dive analysis of the global Single Serve Capsules market. It analyses the global market opportunity and maps out the complex supply chain structure. Order the report [here](#).

AMI is also organising two conferences for the single serve capsules industry in 2019: in [Atlanta](#), USA (5-6 March), and [Berlin](#), Germany (24-25 September).

PTI reviews single-serve capsule technical requirements

The consumer demands continue to grow for single-serve capsules. The complexity of the capsule may not be easily apparent and should not be considered a “simple” package. PTI’s recent research base lined the materials being used, the structures they were assembled into, the resulting barrier (oxygen, water vapour transmission rates) attributes and the impact on taste to produce comprehensive analysis on the package type.

The data reviews requirements, which may start with an iconic design to build brand equity. This iconic shape will be directly interacting with the dispensing appliance, so this design must be intuitive enough to make the consumer experience as simple and pleasurable as possible.

Once in the appliance this “package” becomes an integral element of the appliance itself. Even in the less sophisticated systems the capsule will have at least one or two functions like filtration, opening, dispensing. In more advanced systems, the capsule will trigger the opening process, create the right amount of foam or crema, communicate with the appliance about the contents, adapt to pressure and temperature, provide proper dissolution or mixing. This list of functions and requirements has grown

with every new system created for different applications over the years.

We get excited about all these possibilities of the next state-of-the-art system. However, reality sets in and we must focus on the primary function of the package, which is to dispense and protect the contents. Since the contents are a food product, protection is the primary factor and if we fail at this there is no need to talk about sustainability benefits or cost.

PTI’s research found that that the Barrier Improvement Factor (BIF) varied as much as 380 times across the 18 capsule samples tested (the capsules selected represent most of the major commercially available systems). This is significant since, due to the small size of the package, the barrier requirements are more

challenging. We are talking about a package dimension of 12-55 cm³. The ratio of volume to surface is critical and the material/barrier used for the capsule should be at a 3-4 times lower permeation rate, to overcome the poor area to volume ratio.

The other significant finding from the research is that the way in which the capsule’s individual structural components are assembled to create the final container also impacts barrier characteristics. The PTI’s research also details oxygen and water vapour permeation, overall dimensions, minimum wall thickness, 3D scan to determine active barrier surface, manufacturing process, layer-structure analysis and summary mapping were characteristics reviewed for each coffee capsule type.

About PTI

Plastic Technologies, Inc. (PTI) is recognised worldwide as the preferred source for preform and package design, package development, rapid prototyping, pre-production prototyping, and material evaluation engineering for the plastic packaging industry.

For further information, contact Thierry Fabozzi, President and CEO, tel: +1 419 867 5403, email: t.fabozzi@pti-usa.com



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New generation in high tenacity PP fibres for lightweight geotextile

Mr. Tim Vromman, Technology Manager, BEAULIEU FIBRES INTERNATIONAL, Belgium

Innovative polypropylene solutions based on non-phthalate Ziegler-Natta catalysts

Dr. Cornelia Tranninger, Group Leader "Flexible Polymers", BOREALIS POLYOLEFINE GmbH, Austria

Making appliances more sustainable

Ms. Gisela Lehner, Senior Application Marketing Manager, BOREALIS POLYOLEFINE GmbH, Austria

PP and PE, used as engineering plastics

Mr. Oscar Brocades Zaalberg, Managing Director, BPO nv, Netherlands

A recent solution for halogen-free flame-retardant PP

Dr. Camillo Cardelli, Materials Division IPOOL, Italy

Development of PP building blocks to serve technical compounders in the automotive industry

Dr. Michele Grazi, Senior Scientist, LYONDELLBASELL, Italy

Hybrid, graphene-reinforced multifunctional polypropylene nanocomposites

Dr. Dimitrios G. Papageorgiou, Research Associate NATIONAL GRAPHENE INSTITUTE, UNIVERSITY OF MANCHESTER, United Kingdom

Distracted drivers, rapid industry change & PP parts for great car interiors

Mr. Matt Defosse, Market Development Manager POLYONE, Luxembourg

Novel antioxidant solutions for polypropylene with enhanced colour performance

Dr. Warren Ebenezer, Research Manager for Polymer Applications SI GROUP, United Kingdom

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Design collaboration is key to material success

Resin manufacturers continue to develop materials that not only meet performance needs, but also deliver the aesthetic qualities that product designers are looking for. Mark Holmes reports

Material suppliers for the injection moulding industry are increasingly required to work closely with product designers to achieve the aims of the brand owner, while also striving to meet the performance characteristics that the product needs. The look of the final product may be vital to catch the eye of the consumer, differentiate the product in a crowded market place or highlight important safety features, for example.

Eastman has collaborated with DW Designs to mould and test beryllium models in ear monitor housings using a variety of materials, highlighting the audio clarity of Eastman Tritan copolyester and Eastman Trêva engineering bioplastics. "Eastman wished to understand how our polymers might improve acoustic performance in audio applications," says John Quigley, Senior Application Development Engineer for Eastman. "We worked with DW Designs to test housings moulded in an incumbent polycarbonate material, as well as

Eastman's copolyester and cellulosic resins."

Eastman and DW Designs tested each of the polymers for both cumulative spectral decay (CSD) and total harmonic distortion (THD). Data indicated the copolyester outperformed the polycarbonate, while the cellulosic offered superior results, both in terms of clean response and lower distortion. Specifically, the polycarbonate had the most peaks for resonance whereas the cellulosic had the lowest overall level of measured THD.

Eastman says that data demonstrated that Tritan copolyester and Eastman Trêva engineering bioplastic both have superior damping characteristics relative to polycarbonate. Furthermore, expert listener feedback demonstrated that consumers were able to hear fine details better and preferred the acoustic performance of Tritan and Trêva.

Eastman has also worked with **Solac** to introduce the first double blender made with Tritan copolyester. The Solac Orbit is driven by a powerful

Main image:
Embr Labs
chose Covestro's Makrolon
2407 polycarbonate, a
UV-stabilised
grade that
offers proven
performance
for electronics,
IT and telecommunications
applications, for
the Embr Wave
temperature
bracelet

Right: The Solac Orbit is the first double blender made with Tritan copolyester from Eastman



dual-motor base and comes with a 2.5 litre blender jar and two 500 mL 2GO! containers. Spanish company Solac introduced the double blender in Mexico during the last quarter of 2018 under the name Orbit. The collaboration between Solac and Eastman arose from the need to offer the market a durable and high-quality product.

“One of most used household appliances in the kitchen is the blender,” says Maria Fernanda Riestra Ampudia, Solac’s Senior Manager of Marketing and Product for Mexico and Central America. “The Orbit provides the home and professional segments with excellent performance, power and durability at a fair and accessible price. By offering the practicality of performing two grindings at the same time, it also can reduce preparation time.”

The large blender jar utilises both blender drives to grind food ingredients at a cellular level without leaving fibrous residues or chunks of food and ice. The 2GO! containers provide single-serve preparation flexibility. All Tritan vessels are shatter-resistant and easy to clean. Eastman says that Tritan offers many advantages over glass and traditional plastics, including the ability to resist stains and withstand temperature changes without cracking or crazing. After preparing hot beverages, users can simply wash the container and blend an ice-cold drink without losing clarity or durability. The Solac Orbit blender will be available in Europe in 2019.

SABIC has launched a new PP impact copolymer grade - SABIC PP PPA20 - targeted at demanding home appliances as well as high-end cosmetics packaging, furniture and other household consumer goods. The material offers designers high gloss features that

enables production of aesthetically appealing surfaces. The new compound is developed to offer well-balanced mechanical properties and easy processability, making it a promising alternative to incumbent ABS materials in these markets.

SABIC PP PPA20 polymer is aimed to provide a combination of high gloss, high scratch resistance and low stress whitening over regular impact copolymers together with balanced impact strength and stiffness. In comparison with other potentially more costly and overdesigned solutions, high-gloss SABIC PP PPA20 is engineered to deliver comparable optical properties and scratch resistance along with good processability. In many application cases, the company says that it can offer brand owners, moulders and OEMs a significant cost and energy savings potential based on its lower density, higher flow and faster crystallisation than currently used materials, resulting in potentially shorter cycle times. Further energy savings may be leveraged as the material eliminates the need for pre-drying and can be injection moulded at lower mould and barrel temperatures compared with ABS.

Low density and high flow also open conceivable new material and weight saving design opportunities for more resource-efficient and waste-reducing products, such as sleek housings with lower wall thicknesses. Targeted applications of SABIC’s new high-gloss impact copolymer range from household appliances and food storage containers to toys and furniture. Typical examples include coffee makers, steam irons, vacuum cleaners, personal hygiene appliances and aesthetic fascia for white goods, such as washing machines and refrigerators. SABIC says that PP PPA20 addresses the needs of designers and moulders in these markets for aesthetic as well as cost-efficient and more sustainable materials with higher performance characteristics for functional

innovation and enhanced consumer experience. Already available in the Europe, Middle East and Africa regions, SABIC PP PPA20 is to be phased in commercially in the Americas in 2019.

SABIC has also introduced new Thermocomp HMD-D high modulus ductile glass-reinforced polycarbonate (PC) compounds with increased design freedom, suitable for challenging structural components in the consumer electronics, healthcare and transportation sectors. The new series of six grades offers a combination of



Right: SABIC has launched a new impact copolymer (ICP) grade suitable for household consumer goods, such as coffee makers

high modulus and ductility to enable lighter, thinner and stronger parts that advance design innovation and ease of use.

“From smartphone cases to medical device housings and mass transit interior panels, there is an urgent need on the part of OEMs to replace metal and other traditional materials to reduce weight, expand design freedom and cut processing costs and complexity,” says Joshua Chiaw, Director of Compounds at SABIC. “Thermocomp HMD-D compounds not only avoid the drawbacks of metal, they also add value with breakthrough ductility performance and excellent stiffness, which open opportunities for use in a wide range of structural applications.”

The company says that in order to achieve lighter weight and thinner geometries in structural applications, Thermocomp HMD-D compounds deliver high performance in key mechanical properties that previously were mutually exclusive. The materials

offer both better ductility and dimensional stability/warpage control than other high-modulus PC-based materials. This distinctive combination of attributes allows, for example, the creation of thin-wall devices that may withstand stringent drop testing without cracking. The new compounds use special glass fibres that minimise warpage. Grades with different glass fibre loadings (10-50%) are available to meet various modulus requirements.

Thermocomp HMD-D products also deliver good strength for metal replacement while reducing weight due to their low specific gravity. They provide an excellent surface appearance by minimising the floating of glass fibres to the surface and improved melt flow, which, unlike parts made with various competitive materials, are not affected by heat and moisture ageing. Together with good colour-matching capability and colour stability, these characteristics help manufacturers appeal to

Left: SABIC has introduced new Thermocomp HMD-D high modulus ductile glass-reinforced polycarbonate compounds with increased design freedom in consumer electronics applications



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Surface-optimised Ultramid SI from BASF has been used for the fully plastic frame and armrests for the lightweight Aula chair designed by Wilkhahn, offering new aesthetic and functional characteristics

fashion-conscious consumers of electronic devices and to patients who use home medical devices. All grades feature halogen-free flame retardancy to support sustainability efforts.

New opportunities for designers are now possible with a number of new material developments at **BASF**. For example, speciality polyamide Ultramid Deep Gloss is now available in new colours. The company says that this offers versatile possibilities for car interior design. The material offers resistance to scratching, plus high chemical and good UV resistance. In addition, the high gloss level reproduces structures with faithful detail, allowing a highly contrasting mix of light and shadow - without additional coating.

Ultramid Deep Gloss was awarded the German Innovation Award 2018 in the category Materials and Surfaces. The award is presented by the German Design Council to recognise products from different industries that offer additional benefits compared to previous solutions. **BASF** says that Ultramid Deep Gloss combines the chemical resistance of semi-crystalline polyamides with the high gloss and depth of amorphous plastics. It is therefore particularly suitable for automotive interior components which are high-gloss and yet demand chemical resistance.

Car interior components made of Ultramid Deep Gloss have a high-gloss surface that for the first time does not require an additional protective coating as the gloss surface is achieved with vario-thermal moulding technology. The speciality PA allows designers to realise unusual textures such as ripples, waves, hammer finish, lines and diamonds with a piano-black look, or to structure surfaces with haptic design elements. According to the company, Ultramid Deep Gloss is suitable for components such as air vents and decorative trims,

inlays in car doors, central consoles or dashboards. The requirements of the automotive industry regarding emissions and odours were also taken into account during the development.

New high-performance materials for improving the comfort and safety of autonomous driving are also being developed at **BASF**. Sensors in the car are important in assisting the driver and are an indispensable part of the development of autonomous driving. These include radar, LiDAR, IR or ultrasonic sensors, which function as lane assistants, collision warning systems and distance control, and assistance with the emergency brake function. Designers are using a broad range of **BASF** products, such as the hydrolysis resistant Ultradur HR polybutylene terephthalate (PBT) and the Ultramid EQ PA for these sensitive electronic applications.

The expanded range of Ultradur now includes: Ultradur B4330 G6 HR High Speed, a particularly flowable and laser markable grade with 30% glass fibre reinforcement; Ultradur B4330 G10 HR, a highly reinforced grade with 50% glass fibres; and Ultradur B4331 G6 HR, the next generation with optimised processing characteristics. Ultradur B4331 G6 HR is available from now on as uncoloured grade, in a black laser markable version, and in orange for components in electric cars.

Designers of household goods are also benefiting from new materials from **BASF**. Surface-optimised Ultramid SI has been used for the fully plastic frame and armrests for the lightweight Aula chair designed by **Wilkhahn**, offering new aesthetic and functional characteristics. Employing **BASF**'s simulation software **Ultrasim**, the design ensures that every part of the chair frame can be produced from Ultramid SI, meaning a steel core was unnecessary. This resulted in a new lightweight chair, at only 6 kg or 6.7 kg with armrests. The versatility and performance of Ultrason, **BASF**'s polyarylsulfone, is also opening up new application possibilities for household appliances, for example. For devices such as deep fryers, Ultrason grades can meet requirements where food safety, temperature resistance and design are successfully combined.

Functional solutions made of polycarbonate from **Covestro** are being used in the most confined spaces for an automotive front module concept in a new design. With vehicle construction under major review, alternative drive technologies such as electric mobility, new forms of connectivity and autonomous driving require totally new car



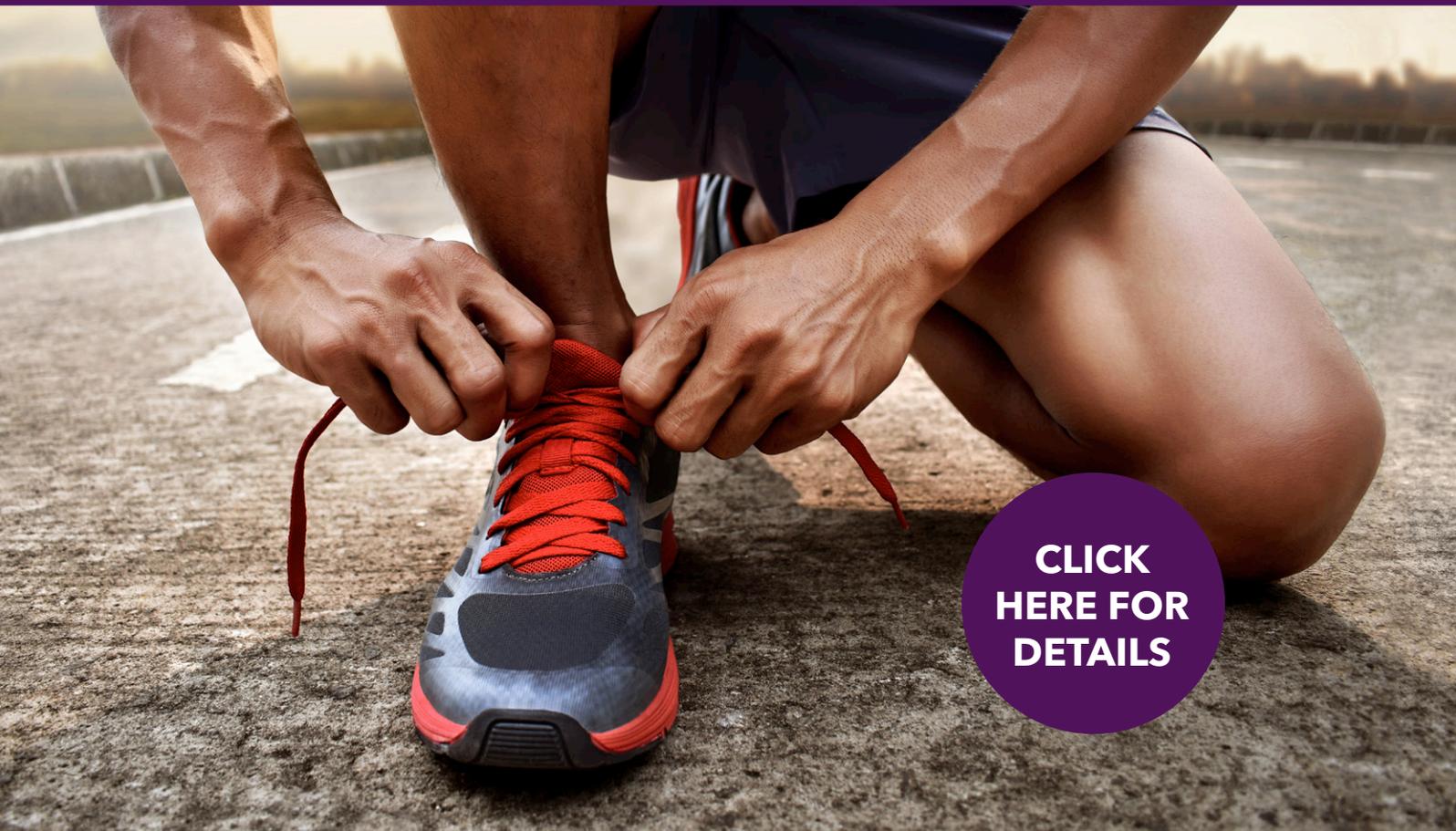
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Above: Automotive front module concept in a new design made of polycarbonate from Covestro

Right: Covestro and its partners have developed a high-performance thermoplastic (HPT) that could be used in many industries, such as aviation, automotive and medicine in large-format production processes

concepts, says the company. Covestro says the front section of future cars will be characterised by three-dimensional, joint-less and glass-like surfaces – the classic radiator grille will be obsolete. According to the company, this enables manufacturers to differentiate their models from the competition, while integrating more functions in less space.

New design opportunities will also be available using a new material from Covestro with a positive eco-balance. Covestro and its partners have developed a high-performance thermoplastic (HPT) that could be used in many industries, such as aviation, automotive and medicine in large-format production processes, which would significantly increase the sustainability and performance of products. The challenge now is to enable the continuous production of the new plastic on a large scale. This is the goal of a research project coordinated by Covestro and funded by the German Federal Ministry of Education and Research (BMBF). Test batches of the new HPT material, which has high hardness and is resistant to heat and many solvents, are already being produced.

Covestro recently attended CES 2019 – the Las Vegas exhibition for the latest consumer product technologies – to demonstrate how, as a materials partner, it is able to help bring next generation technologies to market. Covestro highlighted applications utilising its polycarbonates and polycarbonate blends tailored to electronics, IT and communications applications. The company says that these materials offer a balanced combination of properties including high flowability, stiffness, toughness, heat resistance, flame retardance and good aesthetics.

“Successfully taking a product from concept to commercialisation requires being able to juggle multiple factors,” says Joel Matsco, Senior Market- ing Manager Polycarbonates – Electronics and

Appliance, at Covestro in the US. “We collaborate early on with our customers, helping them to overcome their product design, engineering and materials challenges. This approach accelerates innovation, which is particularly critical given the rapid electronics product life cycle.”

As an example, a highlighted development was Embr Wave – an intelligent bracelet that allows people to alter the way they feel temperature. According to manufacturer **Embr Labs**, the bracelet’s scientifically developed waveforms precisely stimulate a person’s thermoreceptors, leveraging the body’s natural systems to make the wearer feel cooler or warmer by up to five degrees in just a few minutes. The technology is based on a breakthrough physiological insight: warming or cooling specific parts of the human body can make someone feel more comfortable without changing his or her core body temperature. This is because thermoreceptor stimulation – for example, at the wrist – triggers the specific regions of the brain that control thermoregulation and pleasure, says Embr Labs.

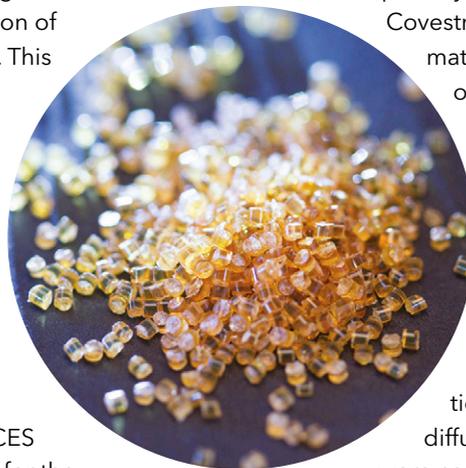
Embr Labs developed the product through years of iterative prototyping and customer testing. When it came time for the production design, the company wanted to use a frosted light pipe with LEDs as the primary user interface. “We turned to

Covestro to help select the right material and optimise the design for optical performance,” says Embr Labs Co-founder Sam Shames.

Based on the requirements, Embr Labs chose Makrolon 2407 polycarbonate, a UV-stabilised grade that offers proven performance for electronics, IT and telecommunications applications. For the Embr Wave, diffusers and optical brighteners were compounded into the resin to achieve the desired visual effect.

An Italian manufacturer of electric two-wheelers has specified the use of Thermolast K from **Kraiburg TPE** for two precision gasketing applications on the new battery boxes of a growing range of power-assisted bikes and electro-scooters. **Askoll**, based in Vicenza, is using the thermoplastic elastomer material for an anti-rattle overmoulding of the battery connector and for water-tight sealing of the battery box. Key requirements to be met included reliable direct adhesion to glass-filled PBT on small contact surfaces.

Electric vehicles need innovative materials that will support their silent travel by eliminating



undesired ambient noises and - in the case of external components such as battery boxes on two-wheelers - ensure a weatherable and water-tight enclosure. This is opening attractive new application opportunities for thermoplastic elastomers, says Kraiburg.

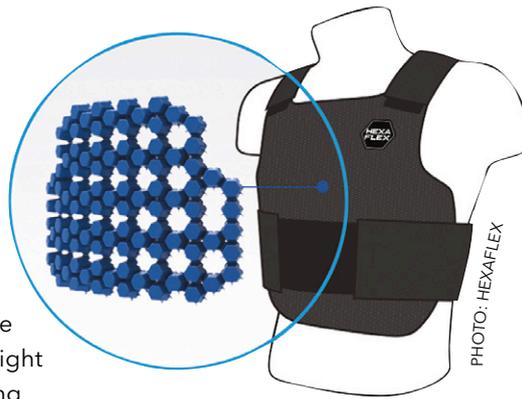
"For the anti-rattle cover of the battery connector and the sealing of the redesigned battery box on our bikes and scooters, we were looking for a material that would provide the right balance of gasketing, mechanical and moulding performance," says Paolo Traubio, Project Manager Scooter, for Askoll. "Kraiburg TPE went a long way in supporting our efforts from concept to market, with qualified assistance in material selection, design optimisation, adhesion testing and moulding trials."

Both TPE applications are injection moulded in a two-component process, which required excellent direct adhesion to the glass-filled polybutylene terephthalate (PBT) resin used for the battery box. In addition, the chosen Thermolast K compound also had to offer good flowability to ensure a precise, tight and faultless fit of the gasket on the narrow contact surface of the lower box component. In addition, the compound lends the critical long-life mechanical properties required to withstand the shocks and vibration of the box when driving, as well as the wear and tear during frequent removal for charging the maintenance-free battery on the electric grid at home or at work.

Kraiburg TPE has also collaborated to develop second skin breathable body protectors with lightweight padding using a flexible TPE compound. French company **Hexaflex** has developed a padding technology based on hexagonal-pyramidal shapes moulded with TPE. The thermoplastic elastomer compound provides the flexibility, light weight and full articulation characteristics of the modular system that lends itself to many shock and vibration absorbing applications, from sportswear and personal protection equipment to healthcare and other demanding industries.

In a first application, the creative technology is used for a dorsal protection product covered with high-strength aromatic PA stretch fabric for bikers and motorcyclists. The lightweight material combination acts like a second skin, and the Hexaflex padding with its interlocking shapes in Thermolast K is fully articulated to follow body motion while ensuring maximum shock absorption.

"Innovative concepts like our Hexaflex system need innovative materials to take them from idea to reality," says Stephane Desnoyers, Founder and CEO of Hexaflex. "Although we knew it would have



Left: The flexible, interlocking and fully articulated Hexaflex shapes moulded in Thermolast K TPE result in a modular padding technology for many applications, including sportswear, personal protection equipment and healthcare

to be an elastomeric solution rather than foam, the success of this project was essentially driven by the expertise found in collaborating with Kraiburg TPE. Besides helping us specify the most suitable thermoplastic elastomer, they supported us with comprehensive assistance from early on in the design phase through to series production."

The Hexaflex shapes can be moulded in various sizes, thicknesses and custom colours. Thermolast is claimed to deliver the long-term flexibility required for reliable articulation of the assembled padding throughout the life time of the protectors. The material has also been shown to minimise rebound when the padding is flexed, which results in good shock absorption performance. Further specifications to be met included good mechanical strength and durability over a wide range of temperatures, ease of recycling, as well as the absence of substances of very high concern (SVHC) in the compound. In addition, the padding is fully washable and waterproof but breathable due to integrated ventilation features in the design.

Following its successful use in dorsal protectors, Hexaflex is planning to extend the technology to other sportswear in the near future, including knee and elbow pads for activities such as skateboarding, snowboarding, skiing and horseback riding. The company also sees broad application possibilities in personal protection equipment, from helmet inserts to breathable harnesses, as well as in anti-vibration floor padding and various healthcare products.

Below: Askoll, an Italian manufacturer of electric two-wheelers, has specified the use of Thermolast K from Kraiburg TPE for two precision gasketing applications on the new battery boxes of a growing range of power-assisted bikes and electro-scooters

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With interest in lightweight structural parts on the rise, especially in automotive, we preview AMI's first North American Long-Fiber Thermoplastics conference

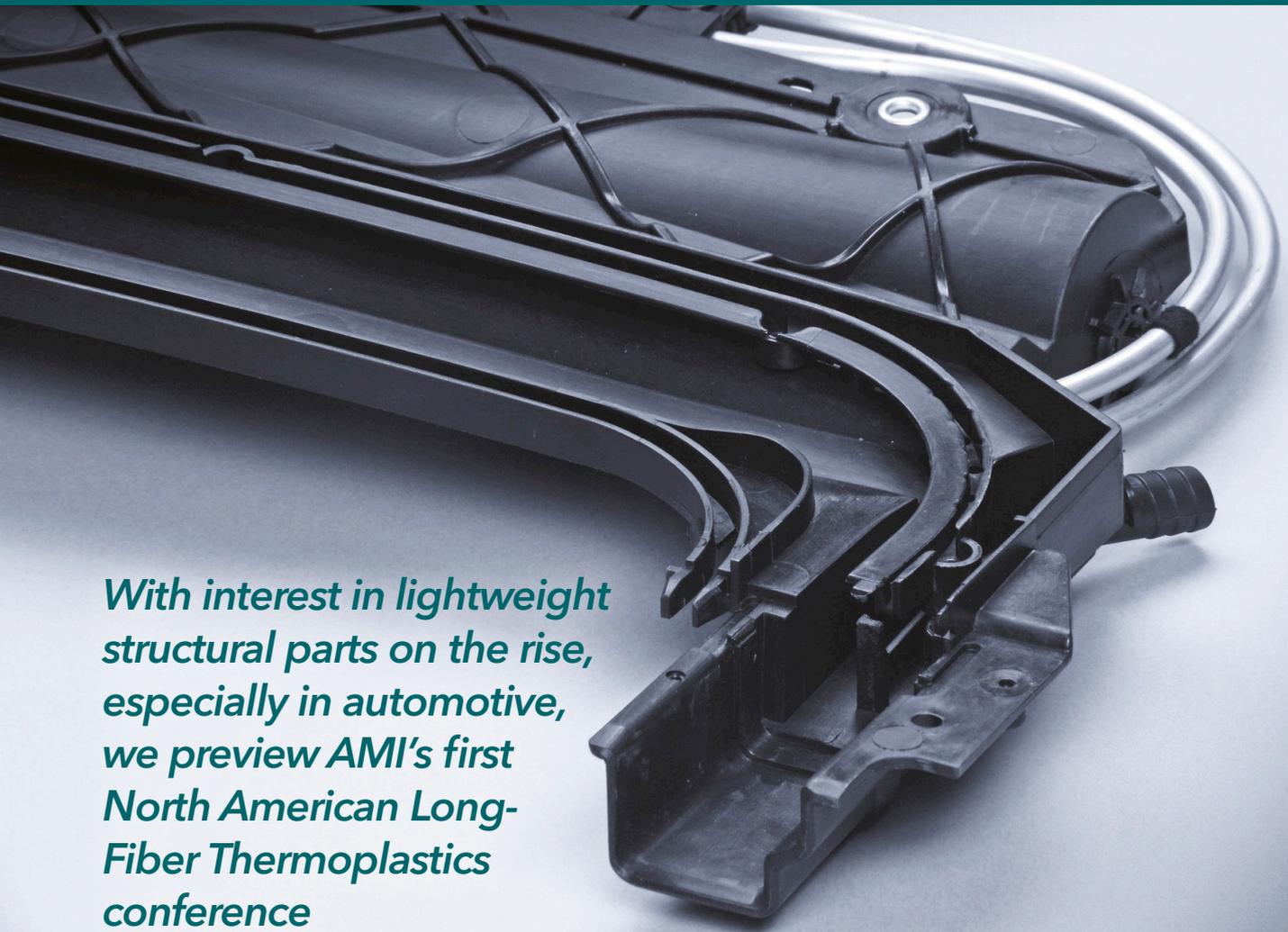


PHOTO: CELANESE

LFTs in the spotlight in US

Main image: LFTs allow structural parts such as sunroof frames to be produced at lower weight and cost due to enhanced part integration

Already established in Europe, AMI launches its Long-Fiber Thermoplastics conference into North America this year. The conference, which will take place in Dearborn, Michigan, in the US on 5-6 March, will bring together key players and industry experts from across the LFT supply chain to explore new advances in LFT materials, processing technologies and applications.

Interest in LFT materials is growing fast, especially in the automotive industry, where OEMs are facing tough global challenges in terms of fuel efficiency and vehicle emissions. LFTs provide new opportunities in terms of strength and mass along with all the productivity and part integration benefits of injection moulded plastics.

The Long-Fiber Thermoplastics expert line up of speakers will share technical and commercial insight into the LFT market, identifying key application sectors as well as analysing end-user and global requirements, and identifying future trends and market challenges. Presentations will cover all aspects of LFT and associated composite innova-

tion, including lightweighting, automotive and appliance applications, LFT production and processing, and reinforcement options.

The conference will open with an examination of lightweight developments in commercial vehicle cockpits, which will be given by **Dr Jeffrey Helms**, Global Automotive Sales Director at **Celanese** in the US. He will be followed by **Jungdu Kim**, Technical Service Manager at **Songwon International** in the US, who will discuss low VOC stabilisation systems for filled PP compounds used in automotive applications.

Dr P K Mallick, Professor at the **University of Michigan-Dearborn** and leader of the Center for Lightweighting Automotive Materials and Processing, will take the discussion beyond LFT with an analysis of development of continuous fibre thermoplastics composites for automotive applications. And **Dr Zhang Chao**, Automotive Engineering Plastics Product Line Manager at **Kingfa** in China, will explore the use of long glass fibre reinforced polypropylene for automotive lightweighting.

Performance matters

The conference will then move on to focus on achieving maximum performance with LFTs. **Dr Jacob Anderson**, Project R&D Engineer at **Nippon Electric Glass** in the US, will provide an insight into the development and optimisation of hybridised glass/carbon composites to balance cost and performance. This hybrid approach will be further considered by **Philip Chu**, Lead Chemist at **Zoltek**, who will discuss production of carbon and glass fibre hybrid composites. Then **Tim Vorage**, Global Market Development Manager at **DSM** in the Netherlands, will look at opportunities for LFTs based on the high performance PA4T resin.

The remainder of the first day takes a more interactive approach, kicking off with an hour-long panel discussion exploring future trends and requirements in LFTs. This will provide an opportunity to share insight across the supply chain. Panel participants include **Maurizio Longhi**, Materials Technology Principal Engineer Resins GSME at **Whirlpool** in the US, and **Sachin Jain**, Managing Director at **SKYiCOMPOSITES** in India.

The panel session will be followed by a series of roundtable discussions running over an hour and designed to give attendees the opportunity to share ideas and brainstorm.

Realising potential

The second day of the conference will be opened by **Dr Eric Martin**, Global LFT Manager at **Solvay Specialty Polymers** in Belgium, who will detail some new performance standards achieved with LFTs. He will be followed by **Michael J Balow**, Senior Adviser at **Asahi Kasei Plastics** in the US, who will discuss hybrid approaches for long fibre applications in PP. Then **Karl Schnetzinger**, CEO of **Advance Polymer Compounds** in Austria, will explain development of a polyamide blend matrix for D-LFT products. And



Expert speakers sharing their insight at Long-Fiber Thermoplastics USA 2019 include, from left, Celanese Global Automotive Sales Director Dr Jeffrey Helms, Kingfa Automotive Engineering Plastics Product Line Manager Dr Zhang Chao, and University of Michigan-Dearborn Professor Dr P K Mallick

Daniel Berg, Global End Use Manager Transportation at **BYK Inc** in the US, will explore the optimisation of coupling agents for LFTs.

Processing technology is the focus for the final session of Long-Fiber Thermoplastics. Compression press development and technology will be covered by **James Geisendorfer**, Technical Sales and Business Development Manager at **Dieffenbacher** in the US. **Robert Roden**, Associate Vice President at **Steer** in the US, will follow with an update on direct compounding of LFTs.

Srikar Vallury, Engineering Manager at **Mold-ex3D** in the US, will share insight into the latest moulding simulation and mechanical performance prediction tools available for LFTs parts. Then **Willen Sundblad**, Founder and CEO of **Oden Technologies** in the US, will explore how intelligent industrial automation and captured process data can be used to solve quality, downtime and production problems. And the conference will be brought to a close by **Dr Juergen Giesow**, Director of Technology and Engineering at **Arburg** in the US, who will look into the latest technologies available to processors using the latest injection moulding technology.

Long-Fiber Thermoplastics USA 2019



Taking place in Dearborn, MI, US, on 5-6 March, Long-Fiber Thermoplastics 2019 is AMI's first North American conference to focus on LFT technologies and applications. A line up of leading international experts will examine the latest developments in the materials, production techniques and end-use applications that are driving growth in the LFT composites market.

Long-Fiber Thermoplastics 2019 will bring together existing and potential end-users and processors of LFTs with key players in the supply chain to learn more about the utilisation, formulation and processing of these versatile, high performance and light weight polymer compounds.

In addition to two days of formal presentations, the conference will provide extensive networking opportunities during the informal refreshment and lunch breaks and first day cocktail reception. The event also includes a table-top exhibition.

For further information visit the [conference website](#) or contact Senior Conference Coordinator Stephanie Hume. Tel: +1 610 478 0800; Email: stephanie.hume@ami.international

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Thin-wall packaging benefits are still stacking up



Despite the hostile public environment for plastics packaging, injection moulders can continue to progress in their pursuit of thin-walled packaging excellence thanks to technology improvements. Peter Mapleston reports

As we reach a tipping point in the use and abuse of plastics packaging, the production of thin-walled parts is taking on heightened significance. Is it a force for good or bad? Will thin-wall packaging help reduce the amount of waste or will it serve to reinforce the popular image of plastics packaging as throw-away products? Probably both. In any case, the plastics packaging industry is in a delicate situation.

The Circular Economy dominated much of the discussion at the Thin Wall Packaging 2018 conference organised by *Injection World* publisher AMI in Cologne, Germany in December. Talks from materials suppliers, machinery makers, packaging producers and major supermarket chains variously emphasised the need to reduce and contain waste, and to increase massively the level of recycling as well as the amount of recyclate that is used in packaging. These arguments are in large part a response to

actual and threatened legislation covering single-use packaging and packaging waste, and to a growing wave of anti-plastics sentiment from consumers, NGOs and pressure groups.

Technology suppliers clearly need to pay close attention to what is happening down the supply chain. "Material preferences are driven by current recycling infrastructure," said Paul Earnshaw, Packaging Manager with Tesco in the UK, at the AMI conference. That puts plastics like polyolefins and PET in Tesco's list of preferred materials, but polystyrene, PVC, polycarbonate, and acrylic get the red light - as do oxy-degradable materials, biopolymers that are only industrially compostable, and even PLA. Tesco plans to stop using such materials this year.

Martyna Fong, Unit Manager - Packaging at AMI Consulting, who co-chaired the event, believes the heightened sustainability agenda will drive

**Main image:
Thin-walled
plant pots with
a flow path:
wall thickness
ratio of 331:1
were manufac-
tured at
Fakuma using a
Netstal Elios
4500-2900
machine**



Above left: Arburg’s hybrid Allrounder 820 H in the “Packaging” version debuted at Fakuma 2018. Above right: At the event, Arburg’s hybrid Allrounder 820 H produced thin-walled IML containers in a four-cavity mould in a cycle time of around 3.8 s

innovation in the market. Certainly the trend among injection moulding machine makers to facilitate the production of high-quality thin-walled packaging continues apace.

At last year’s Fakuma plastics processing show in Friedrichshafen, Germany, for example, **Arburg** premiered its hybrid Allrounder 820 H in its “Packaging” guise, producing thin-wall containers with IML decoration. The electric machine had a 3,700 kN clamp paired with a revised Euromap 2100 injection unit. New valve technology provides improved dynamics and reproducibility at injection speeds of up to 500 mm/s.

The machine was equipped with a four-cavity mould to produce thin-walled 500 mL PP containers (each weighing 15.7 g) with IML decoration using a product handling system from Müller. Cycle time was around 3.8 s.

“Arburg is facing up to the social challenge and recognises the importance of the circular economy,” says Dr Christoph Schumacher, Department Manager Marketing and Corporate Communications. “Our activities in terms of production efficiency help with the conservation of resources during production. Almost any material can be pro-

cessed on Allrounder injection moulding machines, including bioplastics and recyclates. In the case of recyclates, the main problem currently lies in maintaining consistent quality.”

Netstal showed off its high-speed Elios 4500 at Fakuma 2018. Thin-walled plant pots with flow path/wall thickness ratios of 331:1 were

produced using a six-cavity mould from Glaroform. “Despite the high speed, the cycle time of around 2.8 s, and the powerful injection performance, the machine ran effortlessly and smoothly,” says CEO Renzo Davatz. “One of our employees placed a Swiss five-franc coin on a flat surface of the injection unit. The coin remained still for hours. A small unplanned detail, but one that many observers were very enthusiastic about. They checked to see that the coin wasn’t stuck on.”

The Elios 4500 is the model with the smallest clamping force in Netstal’s series built for top performance. The unit at Fakuma had a Euromap 2900 injection unit. Netstal says the Elios series has a unique drive system for the clamping unit, with electrical movement and the hydraulically supported generation of the complete clamping force. For the show model, this gives a 1.5 s dry cycle time with a clamping force of 4,500 kN. Energy consumption is around 0.59 kWh per kg of material, or 9 W per pot.

Wittmann Battenfeld has also been upgrading its range of high-speed machines. At Fakuma it unveiled a 1,600 kN member of its EcoPower Xpress all-electric family, which is dedicated to thin-wall packaging. The family was launched at K 2016, and now has five members going all the way up to 5,000 kN.

All main movements of these machines are driven by water-cooled servo motors. For the secondary movements such as the ejector, nozzle stroke or core pulls, a servo-hydraulic aggregate is used in the standard version. A highly dynamic servo-electric ejector is available as an option.

At Fakuma, an EcoPower Xpress 160/1100+ was making PP lids, using a four-cavity mould and a

Below: PP lids with IML label were produced by Wittmann Battenfeld at Fakuma



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new W837 pro IML automation system from Wittmann. Cycle time was close to 3 s.

Husky is pursuing various routes to help reduce the impact of plastics packaging on the environment, including lightweighting, increased use of post-consumer recycle (PCR) and alternative materials such as biopolymers, and reduction of the energy that injection moulding systems consume in the production of thin-wall packaging. That's according to Manuel Jorge, Manager, Multi-Layer Packaging Solutions, with Husky Injection Molding Systems in Dudelange, Luxembourg.

The company's HyperSync system and machine platform, which debuted at K2016, is available as an integrated system solution for closures and thin wall packaging or as a standalone machine platform. Husky is currently developing a variant of the system, originally developed with a 6,000 kN clamp for barrier packaging, that will be better suited to production of multi-layer containers with core layers of PCR. This will be bigger, with a 10,000 kN clamping unit.

While with current systems, the emphasis is on obtaining a core barrier layer as thin and even as possible to obtain the required level of barrier, the aim of the new variant will be to get as much PCR into the core as possible, while having very thin skins to provide high-quality surfaces. PCR-containing multi-wall containers are likely to be thicker-walled than barrier containers: Jorge says Husky is currently looking into products such as pails with 1.5 mm walls, but he does not rule out production of containers with walls below 1 mm.

Husky has sold over 40 HyperSync multi-layer systems worldwide, around two-thirds of them for production of PET preforms with a core layer of barrier resin or to provide an aesthetic effect. The other one-third, which began being put into operation in early 2018, are for food containers, including coffee capsules.

Husky is now also offering HyperSync

systems for production of multi-layer food cans. Jorge says the company has completed internal trials on such aspects as retortability to prove the feasibility of the system, and it is now in contact with potential customers. He hopes commercial can production could begin around the end of the year.

Jorge provided a presentation on multi-layer technology at AMI's Thin Wall Packaging 2018 conference in Cologne in December (the presentation was actually given by his colleague Christophe Halter). He said that Husky's systems approach – it is the only company in the multi-layer thin-wall sector to provide injection machine, moulds and hot runners, and can also integrate part handling and vision systems – has enabled it to draw ahead of the competition in terms of part quality and productivity.

"Every component in the system has an effect," he says, whether it is force distribution across the platens, temperature distribution in the hot runners, core shift in the moulds, or motion synchronisation though fully integrated controls, he points out. He cites a case study where the Husky system operated with cycle times 20% faster than rival systems and where wall thickness variation and barrier layer distribution was seven times better.

Jorge says that with HyperSync systems, it is possible to produce coffee capsules with 15 micron barrier layers (PP/EVOH/PP) that have an oxygen transmission rate (OTR) of 0.00055 cm³/package/day, or 0.084 cm³/m²/day. Larger packaging – he showed concepts of tuna cans – with a 50 micron barrier could have an OTR of 0.0001 cm³/package/day, or 0.0114 cm³/m²/day.

Thomas Bechtel, Sales Director Packaging & Medical for **Milacron**, says one of the most interesting solutions for thin wall from the company is the Kortec Connect Co-Injection system. This package includes a Kortec co-injection hot half with an E-Multi – a servo-driven, electric auxiliary injection unit. "This combination allows moulders to easily and economically convert any of their existing single-shot injection moulding machines to produce co-injected products," he says. "Kortec Connect can lower the moulder's capital investment requirements by up to 84% versus purchasing a new full-size 2k machine. Also, moulders interested in Kortec Connect have the flexibility to work with any machine or mould supplier."

Bechtel claims Kortec is the number one systems supplier for production of plastics coffee capsules. "Moulders produce over three billion capsules annually using



Right: Husky's HyperSync system

Single-Serve Capsules

Atlanta / 2019

*Identifying opportunities and overcoming obstacles
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Right: St Mamet in France is one of the first food companies to adopt Klear Can

Mold-Masters Kortec co-injection equipment," he says. According to AMI, upwards of 45 billion plastics coffee capsules (mono- and multi-layer) are currently produced each year globally.

"The coffee capsules we see are typically applications with PP/EVOH/PP structure," says Bechtel. "The thinnest capsule we're running has a wall thickness of 0.38 mm with a length: thickness ratio of about 180. This is thin for co-injection with a viscous core material like EVOH. Moulders who convert over to co-injection can maintain the same cycle time as their monolayer equivalent designs."

Kortec systems are also capable of producing biodegradable PLA/PVOH/PLA structures where PLA is compostable, and PVOH will break down in the presence of moisture. "Like any material, there are limitations on how thin you can go with PLA, but overall PLA needs a slightly thicker wall section for a given flow length than PP," says Bechtel.

"What's also exciting about the Kortec Connect system is its ability to produce Mold-Masters' patented Klear Can. This allows for a wide range of new design capabilities that overcome the limitations of traditional packaging like metal cans. Klear Can is already hitting the shelves in markets around the world." Examples include Del Monte's S&W Fine Foods brand in South Korea and China, and St Mamet in France.

For more traditional applications, **Mold-Masters** has introduced its ThinPAK-Series hot runner system, which it claims is the most advanced hot runner system specifically engineered for producing high-quality thin wall packaging products. "ThinPAK-Series has the strength and durability to mould with complete reliability even in high-pressure applications up to 2,800 bar - a 40% higher limit than Mold-Masters' standard manifold designs," says Bechtel.



The hot runners have new nozzles, gate seals and manifold designs specific to the application. The enhanced gate seal geometry is said to provide a robust design that incorporates high-strength material and a larger contact area to withstand the high pressures required for thin-wall packaging moulding operations. The nozzles also feature precisely balanced thermal profiles for improved process control, and the gate seals are serviceable from the parting line. A new valve disk design controls weepage and directs it to easy-to-clean areas. This design is said to extend service intervals by up to three times. The new nozzle and manifold seal is also said to provide greater reliability even on cold start-up.

Sumitomo (SHI) Demag cites Greek food packaging specialist **Kotronis** as a success story for its high-speed injection moulding machines, as the two companies ride the crest of the wave of increasing international demand for Greek dairy products.

In addition to classical Greek food exports like olives and feta cheese, products such as yoghurt and ice cream seem to have weathered and even benefitted from the economic storm, the machine supplier says. Between 2009 and 2017, exports of Greek yoghurt shot up by 204%. Today, Greek yoghurt holds a 7.3% share of the global market, and Greece is the world's fourth largest yoghurt exporting nation.

"Formerly, with the Greek dairy industry predominantly focused on the domestic market, the quality and appearance of dairy packaging was rather irrelevant, but international customers have different requirements," says a representative for Sumitomo (SHI) Demag. "Large global private-label customers in particular needed to be convinced of the value of Greek products while they demanded attractive, practical packaging with pleasant optical and tactile properties."

At Kotronis, Chairman of the Board Giorgos Kotronis says: "Our domestic customers wanted to prove that their products could win the tough



Above: Kotronis operates Systec, El-Exis and IntElect machines in its food packaging production operation. In all, it has around 50 Sumitomo (SHI) Demag machines and more are on the way

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Global groups take a circular turn

An indication of the altered attitudes to plastic waste among multinational companies could be seen at the Ellen MacArthur Foundation's Our Ocean conference in Bali last October, when a global commitment to eliminate plastics waste at source was signed by more than 250 organisations representing 20% of all plastic packaging produced globally.

Businesses that sign the New Plastics Economy Global Commitment will publish annual data on their progress to help drive momentum and ensure transparency. Targets include eliminating problematic or unnecessary plastic packaging and move from single-use to reuse packaging models; innovating to ensure all plastic packaging can be easily and safely reused, recycled, or composted by 2025; and significantly

increasing the amounts of plastics reused or recycled and made into new packaging or products.

January saw the launch of the Alliance to End Plastic Waste by major polymer producers and others, pledging \$1.5bn over the next five years to develop and bring to scale solutions that will minimise and manage plastic waste and promote post-use solutions (see page 13).

"There is no doubt that plastics have played a positive role in improving quality of life for billions of people around the world," says Bob Patel, CEO of one of the founding companies, LyondellBasell. "But like so many other products, responsibly managing their disposal or reuse has become a concern - not just for governments or NGOs, but for all of us."

Polyolefin suppliers in particular

have become highly active in plastics waste reduction and recycling investment. Borealis says it was the first virgin PO producer to explore the possibilities of mechanical recycling by acquiring one of Europe's largest producers of post-consumer polyolefin recyclates, MTM Plastics in Germany, in July 2016. Then, last August, Borealis acquired Austrian plastics recycler Ecoplast Kunststoffrecycling, which recycles post-consumer polyethylenes.

Rival LyondellBasell early last year entered into a joint venture with Suez to acquire Quality Circular Polymers, a plastics recycling company in the Netherlands. Last July, LyondellBasell signed an agreement with the Karlsruhe Institute of Technology in Germany to advance chemical recycling of used plastics.

international competition for shelf space. We were able to assist them with our extensive long-standing experience."

Kotronis began life as a food company, starting a shift to packaging production in 1970. It has been in injection moulding since the end of the last century and now runs 50 injection moulding machines in a 24/7 operation in Nafpaktos, western Greece. "Kotronis is by far the most innovative packaging producer in Greece," says Arnaud Nomblod, Director Business Development Packaging with Sumitomo (SHI) Demag.

Kotronis installed its first high-speed El-Exis SP machine with a hybrid drive in 2007. It now operates 21, with five more on order. It has eight all-electric IntElect machines. The company currently produces around 350 million packaging products per year for deli salads, yoghurt, feta cheese, spreads, antipasti and ice cream. Over half of them end up abroad. A typical production unit equipped with a four-cavity mould produces tubs with 0.45 mm wall thicknesses that weigh 8.6 g, in a cycle time of 4.8 s.

"High availability and high machine speed are the relevant factors that keep us abreast of the competition," CEO Augustinos Kotronis says. "Let's say, a large international supermarket chain wants to launch a 'Greek Week', then we can deliver on the spot, even if the special labels for this cam-

paign are only released at the eleventh hour."

Commercial director Lefteris Antonakakis adds: "In order to implement their visions, our customers are seeking suppliers that share these visions." Kotronis recently cooperated with Greece's largest producer of feta cheese to develop barrier packaging which extends the shelf life of feta cheese in brine without preservatives by six months.

Back at Sumitomo (SHI) Demag, Nomblod says that when it developed the current generation of high-speed El-Exis machines for packaging applications, it focused on optimising energy and resource efficiency. "The El-Exis SP launched last March consumes up to 20% less energy than comparable machines, without cutting corners in terms of performance and quality," he claims. "We are currently exploring the possibilities of a further integration of robots, automation equipment and solutions for visual mould control into higher-level control and management systems."

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- > www.netstal.com
- > www.wittmann-group.com
- > www.husky.ca
- > www.milacron.com
- > www.sumitomo-shi-demag.eu
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AMI's second Single-Serve Capsules conference in North America takes place in Atlanta in March. We take a look at the programme and speakers

Serving a growth market

Single-Serve Capsules, Atlanta 2019 brings together industry-elite speakers from the entire supply chain with the aim of identifying opportunities and overcoming obstacles in the North American single-serve capsules industry. The conference provides a unique forum to debate and evaluate the global trends, innovations, challenges and opportunities facing the industry through the entire value chain of plastic and metal capsules. This includes capsule fillers, coffee roasters, capsule moulders, material suppliers, technology and machinery suppliers as well as companies expanding the scope of applications for single-serve capsules.

From a niche market, single-serve beverage capsules have grown to be one of the most important sub-applications of the ambient thin wall packaging segment in the past five years. Following the disruptive changes to the supply chain in 2012, new opportunities have been created for both end-users and converters to tap into this growing market segment through compatible products. New to this year's conference, AMI introduces a more upstream market focus on product innovation including cold beverage, nutritional supplements and even food applications.

With the growing number of capsules in

landfills, the industry is under pressure - there is an urgent need to review the materials used for capsules conversion in search of more sustainable options, as well as to explore end-of-life solutions. In addition to the busy two-day program, *Single-Serve Capsules 2019* offers high-level networking opportunities in a focused exhibition area featuring displays from a range of suppliers.

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

Market outlook

The opening session of the conference kicks off with **Martyna Fong**, Unit Manager - Packaging at **AMI** in the UK, who gives a global single-serve capsules market overview.

The second session of the conference features a host of innovators who are pushing the boundaries of applications for single-serve capsules. The session opens with **Bryan Fedorak**, Co-founder of **Bartesian** in the US, focussing on cold beverage applications of single-serve capsules and the unique challenges and opportunities they bring. Next **Andrew Cousins**, Technical Key Account Manager at **Alupak** in Switzerland, looks at their success in creating a dynamic single-serve beverage

age system from scratch.

After a networking and refreshment break, **Gian-Carlo Ochoa**, Founder & Executive Chairman from **Güdpod** in the US, discusses how blender pods could be the next generation of single-serve applications. **Carlos Ruiz**, Founder, CEO and Chairman of **Flatev** in Switzerland, presents his vision beyond beverages for the future of single-serve capsules. The final paper of this dynamic session is presented by **Charll van Veen**, Unit Manager Single Serve Brewing Systems from **Frieslandcampina Kievit** in The Netherlands, who looks at a winning combination of dairy with coffee for single-serve capsules.

Capsule advances

The third session starts with **Marius Olszewski**, President and CEO of **Rychiger** in the US, who discusses innovations in the assembly of single-serve capsules. **Pat Seitz**, Vice President Packaging Division at **Hermann Ultrasonics** in the US, then focuses on preserving the aroma with ultrasonic sealing with a closer look at technology advances for the capsule market.

The fourth and final session of Day 1 is a panel discussion featuring **Stephen Schulman**, Senior Vice President Sales / Head of Specialty Coffee from **Lacas Coffee Company** in the US, **Michael Szyliowicz**, Founder of **SolaBev** in the US, **Martin Bussman**, Team Leader Segment Biodegradable Packaging and Technical Marketing from **BASF** in Germany, and **Latisha Tillie**, Senior Brand Manager for TheraFlu at **GSK** in the US. The panel focusses on market trends, innovations and vision for single-serve capsules and will be moderated by **Martyna Fong** from **AMI**.

To round off the day's proceedings, a networking drinks reception is held in the exhibition room, where delegates and speakers debate the conference so far and attendees have the opportunity to network with industry peers.



Speakers at the conference include (from left to right): Bryan Fedorak from Bartsian, Gian-Carlo Ochoa from Güdpod, Charll van Veen from Frieslandcampina Kievit and Gianmaria Pavan from Ahlstrom-Munksjö

Innovations and materials

Day 2 of *Single-Serve Capsules* is opened by **Dave Morton**, Vice President, Multi-Layer Technology Solutions at **Husky Injection Molding Systems** in the US, who looks at unlocking sustainable packaging possibilities for single-serve capsules through multi-layer technology. This is followed by an introduction to certified home compostable beverage capsules given by **Benjamin Haas**, R&D Engineer at **Alpla Werke Alwin Lehner** in Austria.

The final session of the conference begins with a look at an environmentally sustainable solution for single serve coffee through a K-cup compatible alternative from **Gianmaria Pavan**, Head of Beverage at **Ahlstrom-Munksjö** in France, and **Cesare Rapparini**, Owner of **ICA** in Italy.

After the networking and refreshment break, **Steve Davies**, Vice President - Performance Packaging from **Natureworks** in the US, continues the session with his paper on compostable capsules developments. **Shigeaki Yamane**, Global Director of Marketing, Global Business Office, Performance Polymers Division at **Mitsubishi Chemical Corporation** in Japan, then explores a home compostable multilayer barrier packaging solution for single-serve capsules. Closing the conference is **John Moore**, Senior Vice President of Business Development at **Danimer Scientific** in the US, who presents a new generation bioplastic to create home compostable coffee pods.

About Single-Serve Capsules 2019

The second edition of AMI's international *Single-Serve Capsules* conference in North America will take place on March 5-6, 2019 at The Westin Buckhead, Atlanta, Georgia, USA. The event provides an international forum for all companies, through the entire value chain of plastic and metal capsules in the US, to come together and engage with each other over two days - be they end users, capsule fillers, coffee roasters, capsule moulders, material suppliers, technology and machinery suppliers or converters. In addition to the formal conference sessions, the event provides extensive networking opportunities throughout the informal breaks, including access to the table top exhibition area and complementary cocktail reception at the end of the first day. To find out more about attending the conference, taking a table-top exhibition space, or becoming a conference sponsor, visit the [conference website](#) or contact Conference Organiser Agata Swietek: agata.swietek@ami.international Tel: +44 (0) 117 314 8111.



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Polymer-metal hybrid composites are proliferating in automotive applications. Peter Mapleston surveys the latest developments in over-moulding and other processes

Seeking a bond between plastics and metal

Engineering plastics are making a major contribution to weight reduction in automotive, electronic and numerous industrial products by being used in place of metals. In most cases, the replacement is total, but there is also a growing trend to create over-moulded hybrid metal-plastics composites in which the best is made of both materials. The trend is not new – car front-ends built using hybrid technology developed by Bayer (now Lanxess) first appeared in the mid-1990s – but it does appear to be gathering pace.

Current development efforts are leading to improved bond strength between the two materials, and also towards more cost-effective production systems that lend themselves to lower batch sizes.

Polyplastics is one materials company tackling the interfacial issue. Technologies developed during this century have improved bonding force and airtightness at the joint by giving the metal surface physical texture and chemical affinity to the thermoplastic, it notes. “However, since many factors (metal parts, resin materials, mould structure,

injection moulding conditions, etc.) in this method have an effect on bonding, it does not provide stable bonding. As a result, there are still not many examples of this going into mass production.”

Polyplastics emphasises the importance of using the right polymer. For instance, it points to the fact that when there are changes in the local environment after moulding (heat, humidity, for example), bonding capability can decline due to differences between the linear expansion of the metal and the resin, and other factors.

Some compounds offered by Polyplastics incorporate what it calls an “affinity improvement agent” to improve adhesion to metal surfaces. The company offers various grades of PPS and PBT with enhanced metal adhesion. “We are also currently developing even more metal adhesion grades with new functionalities in order to cater to new demands,” it says.

Turning to metal surface treatment, Polyplastics points to new developments, like its Quick-10 technology, which uses rapid heating and cooling

Main image:
Evonik developed Vestamelt Hylink copolyamide-based adhesive promoter to support production of plastic-metal hybrid components

Property	Durafide PPS		Duranex PBT	
	1135MF1 Standard	1150MF1 Low warpage	940MA Standard	930MA Low permittivity
Density, g/cm ³ (ISO 1183)	1.56	1.68	1.57	1.51
Tensile strength, MPa (ISO 527)	162	130	150	130
Tensile breaking stress, % (ISO 527)	1.9	1.7	3.3	3.1
Bending strength, MPa (ISO 178)	227	190	220	195
Flexural modulus, MPa (ISO 178)	10,500	12,800	10,400	8,800
Charpy impact strength, kJ/m ² (ISO 179)	11	6.5	15	11
Deflection temperature under 1.8MPa load, °C (ISO 75-1)	226	260	210	210

Properties of metal adhesion grades offered by Polyplastics

of insert metals to produce direct metal-resin bonding with metal insert moulding alone, without the need for any special surface treatments of the metal. It also highlights metal surface treatments that work without heating/cooling systems.

These include technologies like NMT (Nano Molding Technology, developed around 15 years ago by Taisei Plas in Japan), which uses chemical products to etch the metal surface, and which has been used mostly for production of mobile electronics; NMT has attracted the attention of several major materials companies, including DSM and SABIC.

More recently developed treatment technologies include Laseridge from Japanese company Yamase, and DLAMP from Daicel Polymer (Polyplastics' majority shareholder), which use laser irradiation treatment to perform the surface treatment. Surface treatments using chemicals treat the entire insert metal uniformly, but laser irradiation surface treatment can be more selective, Polyplastics notes.

At the Fakuma 2018 fair last October, **Fraunhofer Institute for Chemical Technology (ICT)** in Pfinztal, Germany, presented a process based on plasma-enhanced chemical vapour deposition (PECVD) to improve adhesion of metal components to over-moulded plastics by creating a "nano-porous" surface on the metal that provides a mechanical key for the plastics melt. Tests using metal-PPS hybrids have shown that PECVD can

increase bond strength by 270%.

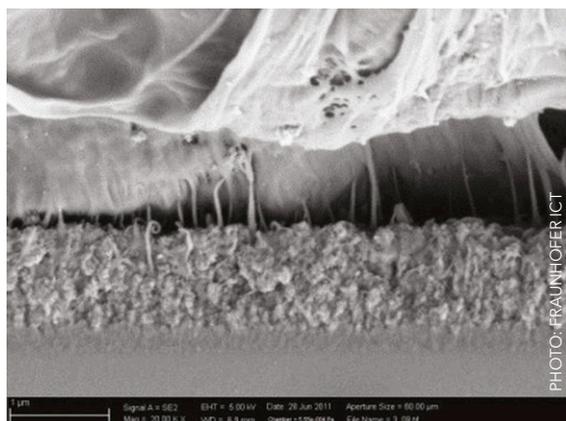
Also at Fakuma 2019, compounder **Akro-Plastic** demonstrated samples of metal-plastic test pieces that show exceptional interfacial bond strength. Moulded over steel, Akromid B3GF30 7 PST, a modified PA6 with 30% glass, showed a tensile shear strength at the bond of over 50MPa - far higher than can be achieved with rival bonding technologies, claims Thilo Stier, Head of Innovation and Sales - while more recent development work has led to very good adhesion to aluminium as well.

Tensile shear strength of over 30 MPa with an overlap area of 12.5 by 25 mm have been obtained, and in some tests, the metal broke before the bond. PST stands for Plasma SealTight, which refers to a plasma treatment process that enables the creation of a bond between metal and plastic that is not only very strong, but is also resistant after thermal cycling to ingress of liquids - something that cannot be guaranteed with standard over-moulding.

The metal insert is first treated using a two-stage atmospheric plasma treatment process developed with another German company, **Plasmatreteat**. The process involves cleaning the surface with one plasma, then applying a silicone-based bonding agent onto the surface using plasma polymerisation. This results in a very thin glass-like layer that can bond with the polyamide when the metal is over-moulded; the whole procedure can be carried out next to the injection moulding machine, as Plasmatreteat demonstrated at K2016, in collaboration with Akro-Plastic and other partners. Stier says the strength of the bond does not fall with rising temperature, unlike with other treatments. The process works with various polyamides and also thermoplastic polyesters, he says.

Plasmatreteat and Akro-Plastic say the process "precisely matches the composition of an anti-corrosive plasma-polymerised layer to the recipe for the plastic compound and the process parameters, to ensure a long-time stable, media-tight bond of the injection-moulded part."

Right: Photo shows cohesive failure of the polymer in a metal-polymer composite with a nano-porous metal layer



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Right: In a shear test to assess the strength of a bond between a plasma-treated metal and an Akro-Plastic polyamide, the metal broke before the bond

In automating the process, Plasmamatreat says it focused on designing a system which is compact and easy to integrate into a continuous production line. It says its PT1200 plasma cell can be adapted to suit any conventional injection moulding machine. The cell contains the generator, robot, control technology, PCU plasma control unit and plasma jets.

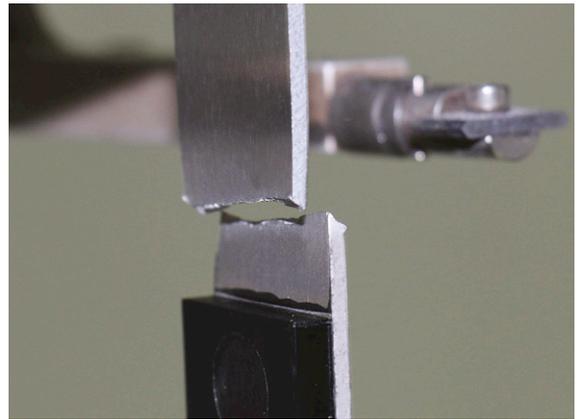
The coating process is based on the PlasmaPlus process developed several years ago by Plasmamatreat in conjunction with the Fraunhofer IFAM in Bremen. This generates functional coatings with the aid of a precursor added to the plasma.

At materials company **Evonik**, Frank Lorenz, a director in the company's High Performance Polymers business, highlights Vestamelt Hylink, a polyamide copolymer that can be applied as a thin (10-25 micron) coil coating or a lacquer onto metal sheet to improve adhesion to plastics in plastic/metal hybrid components. Lorenz says it works with parts over-moulded with polypropylene as well as polyamides.

Lorenz says Evonik's goal was to come up with high-performance manufacturing processes that would reduce the weight of metallic automobile chassis components. One result shown at Fakuma has weight savings of about 20% in two different rear axle control arms, achieved via adhesive bonding with Vestamelt Hylink between the metal and a long-fibre-reinforced PA. The parts were produced in a process called MultiForm (developed in a German government-sponsored project) that not only over-moulds the thermoplastic but also forms the metal plate.

"By combining steel and LFT, it has been possible to reduce the thickness of the steel plate by more than a millimeter from the original," says Lorenz.

One major barrier to entry into hybrid moulding



is the high cost of investment in production equipment. This issue is being addressed on several fronts. For example, the German government-funded MoPaHyb research project (MoPaHyb is an abbreviation for "modular production plant for highly durable hybrid components"), which has just finished, had the aim of developing a flexible system for production of hybrid parts, reinforced with metal inserts and/or continuous fibre laminates.

The system, which has been fully validated, was based around a 36,000 kN vertical press from **Dieffenbacher**, which could be easily connected to a specially developed injection unit with integrated Fibre Direct Compounding (FDC) from **Arburg** - the largest FDC unit Arburg has yet built. The press could also be used for different types of thermoplastic compression moulding. The project was led by Dieffenbacher, and the reference plant was installed at the Fraunhofer ICT.

"Our main input was to develop the process chain," says Tobias Joppich, deputy head of the institute's Polymer Engineering department. "Fraunhofer ICT brought in the production competence for processing hybrid and fibre reinforced materials and defined the production modules to bring everything together in one production line."

The main focus of the project was to create plant layout with modular hardware and controls that

Below: The longitudinal control arm made of high-strength steel plate and Evonik's Vestamid PA12 with 40% long glass fibres substitutes the solid metal part, reducing the weight by about 20%



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Above: A specially-designed Arburg injection unit with integrated Fibre Direct Compounding can be quickly connected to and disconnected from a Dieffenbacher vertical press

could be easily and quickly modified for economic production of small batches of different designs of hybrid parts, Joppich says. "Many metal-plastics hybrid composites are likely to be made in quite small lots, but the necessary investment in production equipment is huge. What we wanted to show was how existing installed machinery can be re-arranged in an economic way. The 'plug and work' plant architecture we have developed can be adapted in a few hours to produce completely new products.

"The consortium developed a general approach regarding the plant controls [from Siemens], which can be adapted to various processes. We have shown that the system works in an industrial environment, but there are still some fundamental questions we are working on concerning designs and different material combinations. We are looking not only at engineering plastics, but also higher performance polymers for applications in aerospace for example. But before we go further, we need to see where the market interest is, and where the funding will come from."

Right: Hybrid composites seat back was developed and produced during the MoPaHyb project

The system developed in the MoPaHyb project uses standardised production protocols and the OPC UA communication interface, as well as the AML engineering language with a unified description of the machinery. "This makes it possible for very different machines from diverse suppliers to interact through a base control unit," says Joppich. Apart from Dieffenbacher and Arburg, the cell also incorporates elements from Siemens (controls), Kuka (robotics), Trumpf (machine tools), A Raymond (fastening systems), Vitronic (vision systems) J. Schmalz (vacuum systems), and others.

Equipment and technology supplier **Engel** also says that some challenges still need to be solved

and more experience needs to be gained before the innovative materials and processes for light-weight composites are used on a large scale. It has provided the **National Composites Centre (NCC)** in Bristol, UK, with an integrated manufacturing cell for over-moulding fibre-reinforced semi-finished products, "paving the way for mass production in both automotive and aerospace industries."

The NCC is one of seven institutes which form the Catapult Network, probably the closest equivalent in the UK to the Fraunhofer Institutes in Germany, carrying out application-oriented research on new technologies in support of local industry.

"Process integration and automation are the prerequisites for achieving the unit costs required by the high-volume automotive industry," says Christian Wolfsberger, Business Development Manager Composite Technologies at Engel's headquarters in Schwertberg, Austria.

Engel supplied a large Duo 1700, 17,000 kN injection moulding machine with a Kuka articulated arm robot and an integrated infrared oven. It is operating with demonstrator moulds based on the geometries of real car components. The sample parts have different sizes and complexities. So far, most parts produced use continuous fibre-reinforced laminates (organo sheets) to provide the reinforcement. Further developments focus on use of tapes. There is no word on whether metal reinforcements will be used though.

"The NCC is an integrated factory," says its Principle Research Engineer, Sean Cooper. "All processes can be developed and optimised in the overall context - from material development to simulation, design and processing to recycling.

"The interfaces are particularly important when it comes to composites. In no other area are material, design and processing processes so closely intertwined. If you change only one of these three factors, you end up with a completely different result." ➤



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Right: The thixomoulded magnesium alloy core of a polymer-metal hybrid composite tyre carrier developed by Leggera Technologies, which won an SPE 2018 Automotive Innovation Award

The capability of combining over-moulding with the thixomoulding process for injection moulding magnesium alloys was demonstrated in an automotive development from **Leggera Technologies** that won the US company a Society for Plastics Engineers Automotive Innovation Award in November 2018. The award in the Process, Assembly & Enabling Technologies category was for the Jeep Wrangler's polymer hybrid composite tyre carrier, developed by Leggera with its partners Fiat Chrysler, TMD Group (acquired by Grammer in 2018) and DuPont.

Leggera Chief Operating Officer Boney Mathew presented the award-winning tyre carrier at AMI's Performance Polyamides conference in Pittsburgh in November. The previous production part was a die-cast magnesium structure with integral steel reinforcements, which had a risk of galvanic corrosion. This was overcome by the new design having a thixomolded magnesium core that is protected by an over-moulded polyamide 66 skin. The polymer-metal composite structure also has improved impact resistance. Other advantages of replacing cast magnesium with thixomolded magnesium in the tyre carrier were that it increased ductility by 10%, reduced weight, integrated a shroud to protect the rear-view camera, and led to cost savings of nearly \$15 per vehicle.

Leggera sees good market opportunities for polymer-magnesium composite automotive parts as the car industry looks for lightweight alternatives to components usually made entirely of metals. At the conference, Mathew showed a slide with potential applications, including a lift gate, skid plate, oil pan and front-end composite beam.

Lanxess continues to evolve the plastics-metal hybrid moulding technology developed by Bayer, which in its original form makes use of injection moulded glass fibre reinforced polyamide 6 in combination with steel or aluminium sheet. Around a year ago, Lanxess extended the scope of the technology to make use of metallic hollow profiles with round or rectangular cross sections.

"Compared to sheet metal, hollow

Lanxess manufactured a demonstrator using its hollow profile hybrid technology, which - compared to a corresponding hybrid component manufactured on the basis of sheet metal - exhibits significantly higher dimensional stability as well as increased torsional strength and stiffness



profiles show significantly higher dimensional stability as well as increased torsional strength and stiffness," says Lukas Schröer, Project Manager for lightweight structures in the company's High Performance Materials (HPM) business unit. "We believe that this new 'Hollow Profile Hybrid Technology' enables the manufacturing of components such as cross car beams, which up until now were not resilient enough using classic plastic-metal hybrid technology."

Once again, cost-efficient processing is a key priority. "It needs to be possible to smoothly and fully automatically place the metal inserts into the injection moulding tool," says hybrid technology specialist Boris Koch. "The result of our development work is a process that is suitable for large scale production, only requires an investment in standard injection moulds and machines, makes short cycle times just like standard injection moulding possible, and is just as simple as the classic hybrid technology using metal sheets."

Lanxess hopes the new hybrid technology will be used for such parts as seat structures, front ends, tail gates, and mirror brackets in trucks. It also sees potential in furniture, ladders, and baby strollers.

Lanxess is currently working on expanding hybrid technology to simple die-cast or extrusion moulding inserts. "Even hollow profile inserts made of fibre-reinforced composite can be used in the new hybrid technology," says Koch.

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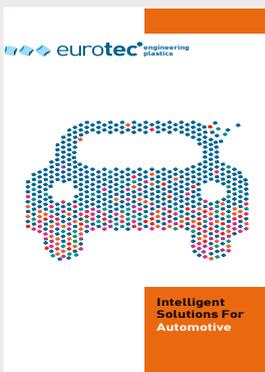
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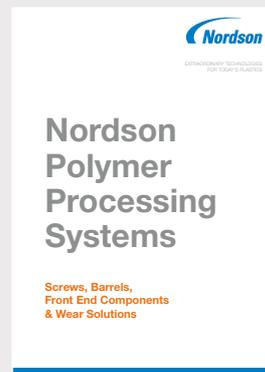
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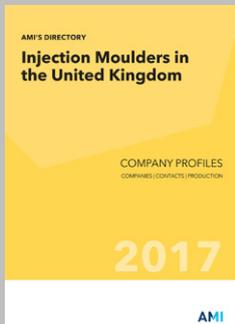
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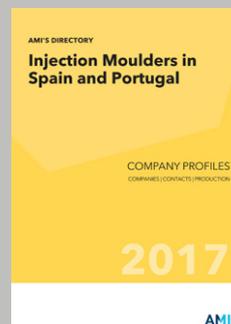
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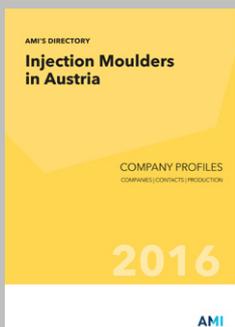
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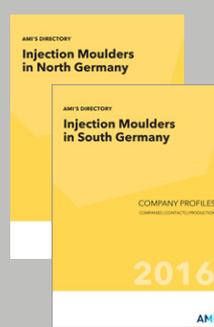
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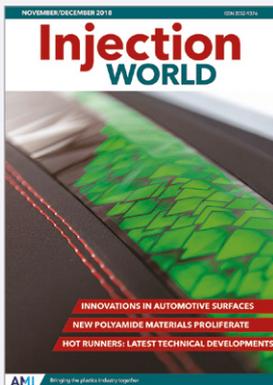
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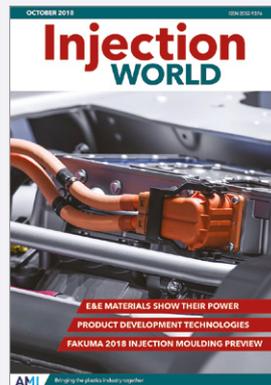
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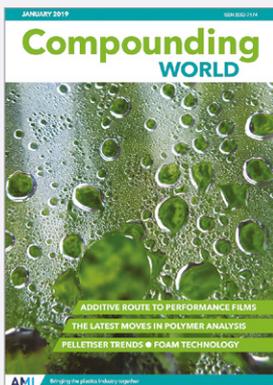
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Injection World October 2018

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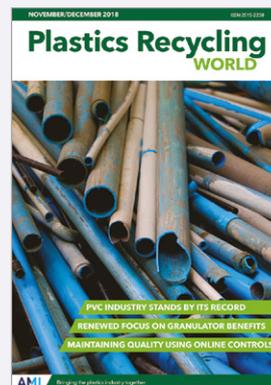
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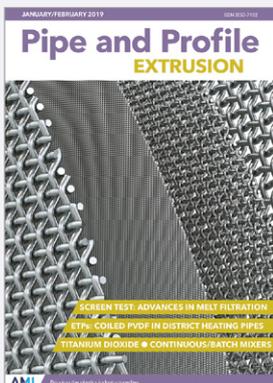
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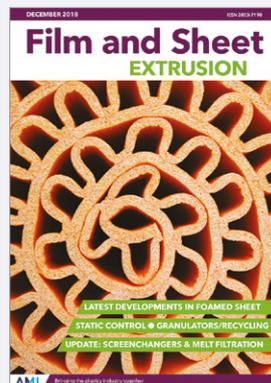
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	12-16 March	Koplas, Goyang, Korea	www.koplas.com
	19-21 March	EU Coatings Show, Nuremberg, Germany	www.european-coatings-show.com
	25-29 March	Plástico Brasil, São Paulo, Brazil	www.plasticobrasil.com.br
	26-28 March	PlastPrintPack Nigeria, Lagos	www.ppp-nigeria.com
	28-30 March	Mecspe, Parma, Italy	www.mecspe.com
	2-5 April	Plastimagen, Mexico City	www.plastimagen.com.mx
	8-12 April	Feiplastic, Sao Paulo, Brazil	www.feiplastic.com.br
	10-12 April	Utech Las Americas, Mexico City	www.utechlasamericas.com
	8-9 May	Compounding World Expo, Cleveland, US	www.compoundingworldexpo.com/na
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8-9 May	Plasttechnik Nordic Malmö, Sweden	www.easyfairs.com	
21-24 May	Chinaplas 2019, Guangzhou, China	www.chinaplasonline.com	
21-24 May	Moulding Expo, Stuttgart, Germany	www.moulding-expo.com	
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