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Trade conflicts hit Haitian's sales

Haitian International's sales in the first half of 2019 fell by 14.8% from the same period of 2018 to RMB 5,009m, which the Chinese company attributed to the slowdown in global economic growth and trade protectionism affecting the market in Asia.

The injection moulding machinery group said: "The global trade conflicts and trade protectionism aroused by the US-led countries have been widely spread, which has caused great impact and influence on the free trade in the world. Not only have these factors slowed down the economic growth of developed countries including Europe, the US and Japan, but they have also attacked the economic

growth of emerging markets."

Domestic sales of Haitian's machinery dropped by 20.5% to RMB 3,320m in the first half, and export sales slipped by 2.1% to RMB 1,546m. Increasing uncertainty about demand in export markets has led to investment caution in China. Haitian said: "We remain cautious and less optimistic about the prospects of

China and the global economy in the second half of 2019."

As well as the US-China trade conflict, Haitian noted two other regional uncertainties: the continuing lack of agreement about the UK's exit from the EU which is affecting the European economy; and recent trade conflicts between Japan and Korea which have indirectly caused adverse effects on

emerging economies in Asia.

Mars series machines, which are Haitian's biggest sellers, were "fairly sensitive" to the economic slowdown and their sales decreased by 18.9% from RMB 3,910m in the first half of 2018 to RMB 3,172m in the first half of 2019. Sales of large two-platen Jupiter series machines dropped by 20.5% to RMB 664m due to market impacts in the automotive and household appliance industries.

Sales of Haitian's Zhafir electric injection moulding machines increased by 13.6% to RMB 773m. The company said this was due to demand for higher performance machines in the market.

➤ www.haitianinter.com



Above: Sales of Haitian's Mars Series machines declined by nearly 19% in the first half of 2019

Polytec buys Wayand auto

The Polytec Group has concluded a purchase agreement for the automotive business of the insolvent Wayand Group of Idar-Oberstein, Germany. This is subject to anti-trust approval and the fulfilment of other suspensive conditions, but is expected to take place in early September.

Wayand employs around 400 in its automotive business area, which mainly produces plastic parts and modules for Europe-based premium automotive OEMs.

Polytec said that the deal is in line with its "strategy of consolidating both its European market position and Car Styling business area". The new business will add some €50m to its annual sales, as well as adding new customers.

➤ www.polytec-group.com

RTP buys Zeotherm TPV line

RTP, a US-based compounder of custom engineered thermoplastics, has acquired the whole Zeotherm TPV product line from Japan's Zeon Chemicals. Todd Gummersbach, general manager for TPEs, described this as "just the latest step in our rapidly expanding TPEs business". This already includes compounds based on SEBS, TPV, TPU, POE, COPE and COPA.

Zeotherm TPV products are available in durometers ranging from 70A to 40D. They offer 150°C continuous use performance while withstanding long-term exposure to engine oils and lubricant greases. They also bond well to PA substrates in overmoulding applications, such that, combined with RTP's Nylabond products, the company says it can now offer a full range of PA-based TPV options to fit the precise requirements of an application.

➤ www.rtpcompany.com



Above: Zeotherm TPV products bond well to PA substrates

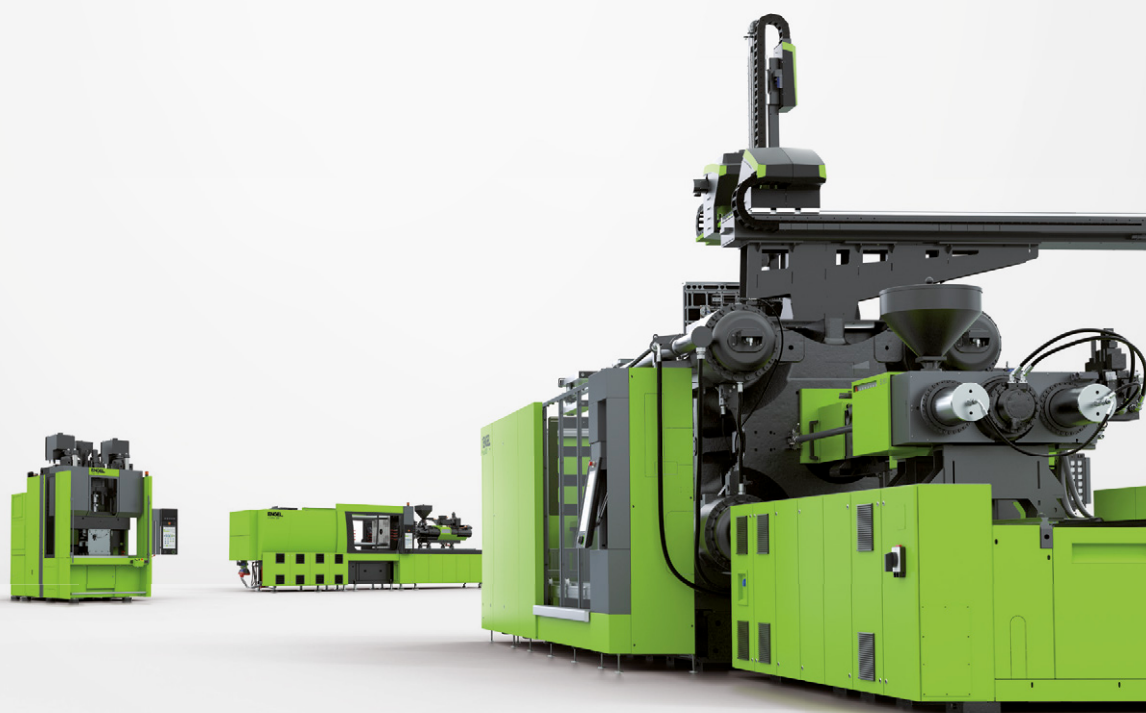


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Domo to acquire Solvay PA business as part of EU deal

Solvay, BASF and Domo Chemicals have reached agreement on the ownership of Solvay's polyamide business that satisfies EU competition requirements. Under this, Domo will acquire Solvay's Performance Polyamides Business in Europe, while BASF will acquire the global, non-European business.

These transactions were initially prompted by the European Commission's requirements for the approval of BASF's agreement in September 2017 to acquire Solvay's integrated PA business. They are all subject to regulatory approval and are expected to be closed by the end of 2019.

The part being acquired by Domo, for about €300m on a cash and debt-free basis, includes engineering plastics operations in France and Poland, high perfor-



Above: Domo Chemicals' polyamide facility in Leuna, Germany

mance fibres in France, and polymers and intermediates operations in France, Spain and Poland. Domo CEO Alex Segers called the acquisition "a major step forward" for the company.

The acquisition will increase Domo's turnover from about €900m to €1.6bn per year, creating "a backward integrated business with unique technology capabilities and a secured supply of key raw

materials". The company will have capabilities in both PA 6 and 66, adding the Technyl brand to its Donamid and Econamid ranges for the automotive, food, medical, pharmaceutical, chemicals and electronics industries, among others.

The part being acquired by BASF for about €1.3bn, also on a cash and debt-free basis, includes eight production sites in Germany, France, China, India,

South Korea, Brazil and Mexico, three R&D centres in South Korea, China and Brazil, and six technical consultation centres in Asia and the Americas. It also includes Solvay's 50% share in Butachimie's production of adipodinitrile (ADN) raw material. It will also enter into a joint venture in adipic acid with Domo in France, employing about 650.

BASF is planning to integrate the businesses into its Monomers and Performance Materials divisions. The company said that it will gain improved access to important growth markets in Asia and South America, enhance its product pipeline and gain backward integration into important raw materials like ADN, placing it along the entire PA 66 value chain.

➤ www.domochemicals.com
 ➤ www.solvay.com
 ➤ www.basf.com

Magna to build fifth auto plant in Ohio

Tier 1 automotive supplier Magna has held a groundbreaking ceremony at its new seat structure plant in Lancaster, Ohio, with dignitaries including US Vice-President Mike Pence in attendance. The 14,000 m² facility, which involves an initial investment of about \$60m, is being built after the company won new seating business in North America with a global OEM.

The site is the company's fifth in Ohio, where it currently employs about 2,700 people, but the first dedicated seat structure plant in the US. It will feature robotic laser and MIG welding capabilities. The first seats will be supplied for a new plug-in hybrid vehicle. The plant is expected to be operational in Q1 2020. It will employ 300 and has scope for further expansion.

➤ www.magna.com



Above: US Vice-President Mike Pence (fifth from right) attended the groundbreaking event

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www.arburg.com

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Vuteq to build US plant

Vuteq USA, the US subsidiary of the Japanese Tier 1 automotive supplier, is to spend over \$60m to open its first manufacturing facility in Alabama. This will produce interior and exterior injection moulded parts and sub-assemblies for the \$1.6bn Mazda Toyota Manufacturing USA auto assembly plant, which is now under construction on a 1,000-hectare site at Huntsville.

Construction work at the Vuteq facility is scheduled to begin in October and be completed in September 2020, followed by initial production trials of equipment, moulds and secondary systems. Production is expected to begin in 2021. The company is already recruiting and employment will reach about 200.

The Vuteq site will also house several other manu-

facturing companies, including the Diversity Vuteq minority joint venture. This will be the fifth of the network of parts suppliers in North Alabama to support the Huntsville assembly operation. In total, these companies are investing \$440m and creating nearly 1,700 jobs.

Vuteq employs 13,000 worldwide and supplies Toyota with various services including logistics and parts such as interior trim, door trim and cockpit assemblies. This will be its first work with Mazda. The company began North American operations in 1987 at Toyota's assembly plant in Georgetown, Kentucky, and has others in Indiana, Texas, Mississippi and Ontario, Canada

➤ www.vutequsa.com



IAC to expand UK presence

The International Automotive Components (IAC) Group is to expand its main facility in the UK at Elmdon, near Birmingham, including highly automated process manufacturing. It has signed an 11-year lease for two buildings, with a total floor space of 28,800 m².

The site will be used for manufacturing, assembly and sequencing. It will also house certain centralised functions, including engineering, programme management, commercial, finance and IT.

The decision follows growth through supplying to multiple models for its sole customer, Jaguar Land Rover. IAC, which is headquartered in Luxembourg, currently supplies components and interior trim to the Land Rover and Range Rover models. It anticipates full production at the site in 2021 and will create an additional 400 jobs in the region.

➤ www.iacgroup.com

Pexco acquires two more firms

Speciality plastics extruder Pexco of Alpharetta, Georgia, US, has acquired both American Extruded Plastics (AEP) and American Injection Moulding (AIM) from founder Marshall Eakes. The two firms are based in the same facility at Greensboro, North Carolina, and supply the life sciences and diagnostics, telecommunications, agriculture, automotive, construction, consumer goods and packaging markets.

Pexco CEO Sam Patel said: "The addition of moulded plastics to our existing base of core competencies aligns well with our ongoing desire to broaden Pexco's overall value proposition by providing integrated solutions to our customers."

The company sells standard and speciality extruded parts and components for custom applications.

➤ www.pexco.com

Toyoda Gosei in 3D printer investment

Japan's Toyoda Gosei is to invest about \$420,000 in Slab, a Kyoto venture company that manufactures plastic 3D printers, with a view to improving their speed and precision. "This will both speed up product

development and advance the development of flexible production technology for the efficient manufacturing of low-volume, high-mix products," it said.

The company added that the automotive industry "is

going through a time of accelerated change, with intensified competition in the development of new connected, autonomous, shared, electric (CASE) technologies. This demands technical innovations in

development and production that are not bound by existing frameworks." Until now, the use of plastic 3D printers has been limited because of product quality and forming times.

➤ www.toyoda-gosei.com

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Clariant and SABIC suspend performance merger plan

Clariant and SABIC have temporarily suspended discussions aimed at creating a joint High Performance Materials business from the former's Additives and high value masterbatch operations and some of the latter's Specialties units. The decision has been made due to current market conditions, the two companies said.

Clariant added it will continue with the previously announced divestment of its Pigments business and that

it will now also sell the entirety of its Masterbatches business by the end of 2020 (it had previously planned to retain the high value part). Proceeds from the divestments will be invested in innovations within the core business areas.

Shortly before the suspension announcement, Clariant CEO Ernesto Occhiello - who joined Clariant from SABIC last year after it acquired a 25% stake in the Swiss firm - resigned "for personal

reasons with immediate effect". Former CEO and chairman of the board Hariolf Kottmann has taken over his role until a replacement can be found.

Clariant said sales from continuing operations grew by 4% in local currency terms to CHF2.23bn (€2.0bn) in the first half of the year, thanks to higher volumes and pricing. EBITDA before exceptional items for continuing operations fell by 2% to CHF355m (€323m). Kott-

mann described the half-year as "admittedly challenging", especially Q2 "which was additionally impacted by temporary negative influences and one-off occurrences".

The strongest business areas were Catalysis and Natural Resources. The discontinued Masterbatches and Pigments units were 2% down, "negatively impacted by the weakened economic environment".

➤ www.clariant.com
➤ www.sabic.com

Experts headline AM event

Leading experts on additive manufacturing (AM) are speaking at AMI's Polymers for 3D Printing conference in Germany on 11-12 December.

The first keynote presentation on design for AM is by Connor Myant, Assistant Professor at Dyson School of Design Engineering in London, UK. Tina Schlingmann, AM Technology Scout and Material Expert at Deutsche Bahn, will discuss how the German rail company is innovating with 3D printing technology. ABS, PEEK, TPU and continuous fibres are among the subjects at the event.

Find more details here.

PMDM plans Mast expansion

Precision Motors Deutsche Minebea (PMDM) of Villingen-Schwenningen, Germany, has acquired Bad Waldsee-based Mast Kunststoffste. This is described as part of a company succession plan on the part of the Mast brothers, who have run it for 30 years. The deal is still subject to approval by the antitrust authorities.

PMDM said that this buy "strengthens and broadens its product range in the development and production of drive components". It will seek to consolidate and expand Bad Waldsee as a European competence centre for precision plastic parts in this field. Mast will continue to operate as before, and Peter and Ulrich Mast will be available to the new owner and the employ-



Above: Mast produces plastic gear and drive components

ees in their function as managing directors.

PMDM says it is the largest motor development centre in the international network of Japan's Minebea Mitsumi Group. It employs about 400 and makes hard disc drive motors, electronically commutated BLDC motors and energy harvest-

ing systems, as well as drive systems.

Mast employs 130 and is a major supplier of plastic gear and drive components.

The company makes its own moulds as well as carrying out injection moulding, plus printing, and other services.

➤ www.pmdm.de

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Polymer majors report difficult trading in first half of 2019

First half results from BASF, Covestro and Radici Group highlight increasingly challenging trading conditions, particularly in the automotive market.

BASF said "significantly weaker than expected industrial production" impacted both its volumes and margin development. It said this was particularly pronounced in the automotive sector, where production fell by 6% globally and by 13% in China. As a consequence, the company's preliminary Q2 sales figures were 4% down on Q2 2018 at

€15.2bn; EBIT was 71% down at €500m due to much lower earnings in its Materials, Chemicals and Agricultural Solutions segments.

BASF said it now expects a slight decline in sales for the year as a whole and a 30% fall in EBIT before special items. At the start of the year, it had anticipated slight growth in each.

Covestro saw a 16.9% fall in group sales to €3.2bn. It said lower selling prices cancelled out a 1.1% increase in volumes in a situation of "ongoing intense competitive pressure and

uncertainties in major sales markets". EBITDA was 53.4% down on an outstanding Q2 2018 at €459m, mainly from lower margins in the Polyurethanes and Polycarbonates segments.

Covestro also said the automotive market "developed much weaker than expected" but that construction was relatively strong. It confirmed its guidance for fiscal 2019 of core volume growth in the low- to mid-single digit percentage range and EBITDA of €1.5-2.0bn.

Italy's RadiciGroup

reported an excellent 2018, with consolidated sales revenue up by 6% to €1.2bn and EBITDA up 16% to €185m. However, it said it is now feeling the effects of a slowdown that began late last year. RadiciGroup President Angelo Radici said he saw "stable margins despite the contraction in sales volumes" in the first half of this year but expected conditions to be "a bit tougher" in the second half, due to global uncertainty.

➤ www.basf.com

➤ www.covestro.com

➤ www.radicigroup.com

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Majors target CFRT tapes

Two announcements have highlighted the growing interest of polymer producers in the potential for continuous fibre-reinforced thermoplastic (CFRT) tapes used in advanced composites manufacturing.

Fibre manufacturer Toray Advanced Composites and BASF have signed a manufacturing and supply agreement focused on the production of CFRT tapes for the automotive and industrial markets. Toray will make the tapes using BASF's Ultramid PA resins, which it will reinforce with either glass fibre or carbon fibre.

The two said that the deal will make CFRT material more widely available, thus facilitating the adoption of advanced materials for lightweight, structural components in a wide range of industrial markets. In particular, automotive manufacturers can use



PHOTO: TORAY

Above: Toray and BASF signed a manufacturing and supply agreement

them to produce optimised components at a lower cost, while using the latest fabrication methods, like automated stamp forming and overmoulding.

Covestro announced it is further developing its Maezio brand of CFRT composites impregnated with thermo-

plastics including polycarbonates, in response to market trends and a growing demand. It has added a new R&D tape line in its Leverkusen laboratory and hybrid injection moulding machines at Markt Bibart, southern Germany, and in China, to support this expansion.

"We're witnessing strong market demand for thinner, lighter, and aesthetically competitive products where thermoplastic composites like Maezio are making a difference," said Lisa Ketelsen, head of Covestro's thermoplastic composite business. "The new tape line, in combination with our mass production lines, will allow us to do quick iterations and scaling based on market demand."

➤ www.toraytac.com

➤ www.basf.com

➤ www.covestro.com

An advertisement for BOY Spritzgiessautomaten (spray casting machines). The central graphic is a blue and white globe with the BOY logo and the text "Spritzgiessautomaten" overlaid. Surrounding the globe are various models of industrial machines, each labeled with its specific name: BOY 25 E HV, BOY 25 E VV, BOY 25 E VH, BOY 35 E VV, BOY 35 E HV, BOY 35 E VH, BOY 55 E VV, BOY 25 E V, BOY 25 E, BOY 35 E, BOY 50 - 60 E, BOY 80 - 100 E, BOY 125 E, BOY XS V, BOY 2C XS - L, BOY XXS, and BOY XS. The machines are depicted in blue and yellow, typical of the BOY brand.

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Plastics injection moulding is providing significant advances in optics and lens technology, writes Mark Holmes

Seeing the way forward in optical moulding

New developments in optical and lens technology are ideally suited to the injection moulding process and a number of machinery manufacturers are leading this progress. The current market trends in optical injection moulding applications can be divided into four areas, says **Arburg**. These include LSR lenses for matrix headlamps and headlamp systems, as well as micro lenses, for example in camera systems and sensor technology. Fresnel structures are used, for example, for lighter lenses. In a Fresnel lens, the volume is reduced by dividing it into ring-shaped areas of approximately the same maximum thickness. Due to the required curvature of the surfaces, the lens has a series of ring-shaped steps. LED lighting is a further application area.

Rolf-Uwe Müller, optics expert from Arburg's application engineering consulting team, adds that new technical developments in optical moulding applications are being driven by freedom of design with the respective degrees of freedom and the

possibility of manufacturing precise nanostructures by injection moulding and injection compression moulding. "As in many other industries and fields, the requirements placed on plastic optical parts in terms of design and properties are constantly increasing," he says.

"New materials, mould technologies and injection moulding machines need to adapt to this. From an application technology point of view, Arburg is always guided by what the industry needs and incorporates the experience and requirements of the industry into its own approaches. From this, Arburg develops new solutions that can be implemented for specific applications and users - ranging from stand-alone solutions to turnkey projects."

He says that in this respect, Arburg sees itself as a partner to its customers along the entire value chain, from development to operational technology solution. "As a primary contractor, Arburg is

Main image: A trend to using Fresnel lenses is connected to their light-weight structure

Right: Arburg participated in the OptiLight research project for the energy-efficient production of hybrid lenses for LED street lighting

able to provide individual production cells including complete cleanroom cells," he says. "The electric Allrounder injection moulding machines are particularly suitable for the production of high-precision optical parts. However, this is a field in which innovations are driven primarily by mould construction and new materials. Arburg provides customers with positive support by providing an injection compression moulding process tailored to the material and mould. The compression moulding sequences can be freely programmed on the central Selogica control system without the need for any additional programs."

The company adds that its injection compression moulding software is continuously being refined. "As a process, injection compression moulding makes it possible to produce low-stress, thick-walled components without sink holes and with a high degree of contour accuracy," says Inna Meder from Arburg's application engineering consulting team. "This complex process sequence can be used to realise innovative applications, including precise free-form surfaces. Injection compression moulding is a variation of the injection moulding process. It is characterised by a change in cavity volume during the ongoing injection and/or holding pressure phase. In injection compression moulding, the mould is usually not yet completely closed during injection. Only after the melt has been introduced into the cavity, will the mould be closed completely. This means that less pressure has to be applied to fill the cavity, reducing the pressure gradient during the filling phase. When the mould closes, uniform compression is then applied to the complete cavity surface of the shrinking component. The mould must therefore be designed in such a way that the cavity is sealed even if the mould is not completely closed. This enables the production of low-stress, thick-walled components without sink holes and with a high degree of contour accuracy."



PHOTO: ARBURG

Arburg adds that it uses hydraulic and electric injection moulding machines for injection compression moulding. The hydraulic Allrounder S models are characterised by long compression paths and large compression forces, whereas the electric Alldrive series ensures positioning accuracy in the range of 1/1,000 mm.

Arburg was involved with the OptiLight research project for the energy-efficient production of innovative hybrid lenses for LED street lighting. Using injection compression moulding, precise free-form surfaces are produced which direct the light into a rectangular illumination profile. The energy-efficient LED lenses are manufactured using an equally energy-efficient electric Allrounder A injection moulding machine with a clamping force of 600 kN. The servo-electric toggle-type clamping unit stands out for its reproducible, dynamic injection process. A hydraulic ejector enables long compression processes with high forces. The production cell is equipped with a vertical entry Multilift V for gentle removal of the lenses. The project is funded by the German Federal Ministry of Education and Research (BMBF) and supervised by the Project Management Agency Karlsruhe (PTKA). The goal is an efficient production chain for high-volume production of microstructured, thick-walled polymer hybrid lenses.

Arburg cites another example in ophthalmic lenses for spectacles, where the thickness of the component can be adjusted by means of the compression path. The compression time for a lens of 10 mm thickness is 90 s, using a hydraulic injection moulding machine with multi-pump technology.

The electric Allrounder injection moulding machines are also ideal for high-precision optical applications, such as automatic production of optical waveguides made from polycarbonate, says the company. Due to the microstructures measur-



Light conductors play a crucial role in focusing and conducting the light from 40 LEDs in a car headlight. With an Allrounder 520 A, these precision parts made of liquid silicone are produced by Wilhelm Weber from Esslingen, Germany, for its customer Hella. They are used in cars such as the Audi A8

PHOTO: ARBURG

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PHOTO: ENGEL



Above: Engel connected two Duo injection moulding machines to produce thick-walled LED lenses

ing 5 nm on the surface, the highest possible parts quality and precision are required.

Looking at future developments in optical moulding, Arburg adds that the current market trends will be further refined and their requirements will increase continuously. "This means that the demands on precision in injection moulding will also continue to increase," Rolf-Uwe Müller says. "In this respect, Arburg is well prepared for the challenges ahead with its electric Allrounders, its injection compression moulding process, its powerful control systems and the ability to easily integrate special processes, as well as its adapted and fully integrated Multilift robotic systems. This is supplemented with advice on application technology and coordinated service that guarantees high technical availability over long periods of time."

Plastics are increasingly being used to produce high quality optical components, reports **Engel**. This is because polymeric materials are lighter than glass and offer product designers more freedom. Engel is providing a wide spectrum of technologies processing both PMMA and polycarbonate materials, as well as LSR for optical applications. The company adds that it has developed a manufacturing cell for LED lenses made of PMMA with a thickness of 22 mm for vehicle headlights using two Duo injection moulding machines. In order to increase efficiency in producing thick lenses, Engel has developed Optimelt technology with external cooling. Initially, a preform is produced and further layers of the same material added to it in subsequent stages. Overmoulding compensates for any sink marks in the surface of the previous layer and achieves high optical quality. Optical tests have shown that the boundary between the layers has no influence on the performance and function of the lighting optics. Because the cooling time in injection moulding increases with the square of the wall thickness, the multilayer technology significantly improves efficiency especially in the production of thick-walled components. Several thin layers cool in total faster than one thick layer. If, in addition, the base body of the lens is removed

from the mould to cool, the cycle time is shortened further. Cooling in the air takes longer than in the mould, but it does not affect the cycle time.

The lens base bodies were produced on an Engel Duo 1060/400 injection moulding machine in a 4-cavity mould. An Easix articulated robot is integrated in the production cell and removes the four parts and passes them to an external cooling station. From there the robot takes four already sufficiently cooled preforms at a time and transfers them to the 4 + 4 cavity mould of the Duo 600H/600H/500 combi multi-component machine with rotary table. There, two more PMMA layers are applied successively before Easix removes the finished lenses. The cycle time is significantly lower than three minutes, although the preforms take around 30 minutes to cool. The cooling time can be controlled via the number of cooling positions in the external cooling station. The combination of a standard injection moulding machine and a two-component machine is synonymous with very high production flexibility. Both machines can also be utilised independently of the other with different moulds.

Engel adds that liquid silicone rubber can be processed efficiently in injection moulding and also has good material resistance. LSR is therefore becoming increasingly important as a material for optical lenses in lighting technology. By manufacturing LED headlamp lenses on a tie-bar-less Engel E-victory 310/120 injection moulding machine in an automated, rework-free process, the company says that geometrically highly complex LSR products can be manufactured economically in large quantities.

The automotive industry is increasingly exploiting optical silicones for lighting systems. In addition to this, LSR is also becoming increasingly important as a lens material for street and building lighting. ➤

Right: Engel's Optimelt multilayer technology with external cooling can produce thick-walled lenses to combine high optical quality with high production efficiency



PHOTO: ENGEL

PA PBT PPA PET PC PP TPU PK POM PPS PEEK



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Right: The iQ weight control intelligent assistance system compensates for fluctuations in the raw material and ambient conditions before rejects are produced

Like the established thermoplastic lens materials PMMA and polycarbonate, silicone offers significant weight savings compared to glass. However, LSR is superior to organic polymers in terms of thermal and chemical resistance. Highly transparent grades for optical applications have a lower yellowing index than thermoplastic lens materials. They are extremely resistant to environmental influences such as UV radiation and can be used over a wide temperature range from -40 to +200°C. In addition, they allow particularly flexible design. In terms of the geometry, there are almost no limits when processing LSR in injection moulding.

Engel demonstrated the procedure by processing Dowsil MS-1002 Moldable Silicone from Dow Silicones, a material developed specifically for use on injection moulding machines. The curing speed has been optimised to obtain a smooth and hard surface similar to thermoplastic. The high light transmission ensures a good luminous efficiency. In addition, the high thermal stability enables an outstanding transparency. The surface, with its extremely filigree structure, is moulded with highest reproducibility. The LED lenses leaving the production cell are ready for installation.

"The prerequisites for economically producing geometrically demanding products from liquid silicone are automated, rework-free processes as well as high precision and stability of the injection moulding process," says Gero Willmeroth, the President East Asia and Oceania at Engel. "Thanks to its tie-bar-less clamping unit, the E-victory machine with an electric injection unit is predestined for this."

According to the company, tie-bar-less injection moulding machines offer a number of advantages for processing LSR. The fact that the robot can reach the cavities directly from the side without having to circumvent any obstacles reduces the handling time, and therefore the mould opening time. On top of

this, the tie-bar-less technology allows for particularly compact production cells. Because there are no tie bars in the way, the mould mounting platens can be fully used up to their very edges. This means that the high-volume lens mould necessitated by the complex component structure fits on a comparatively small 120 tonne injection moulding machine.

Engel adds that one of the reasons for the accurate reproduction of surface detail is the good parallelism of the mould mounting platens. The patented force divider ensures that the moving mould mounting platen follows the mould precisely while clamping force is building up and that the force introduced is evenly distributed across the platen surface. When multi-cavity moulds are used, the parting lines of all cavities experience the same surface pressure. This prevents flash when processing very low-viscosity silicones, and avoids reworking of the injection moulded parts.

Engel has equipped the E-victory with iQ weight control for the manufacture of the LED lenses to ensure the required precision during injection throughout the entire manufacturing process. The intelligent assistance system from Engel's Inject 4.0 program analyses the pressure profile during injection of the polymer melt, compares the measured values with a reference cycle and adjusts the injection profile, the change-over point and holding pressure shot by shot to the current conditions. Fluctuations in the raw material and ambient conditions are automatically compensated before even a single reject moulding is produced. The camera system integrated in the process checks and documents the quality of the parts.

An Engel Viper 40 linear robot is used for parts handling.

Sumitomo (SHI) Demag Europe agrees that LSR is probably where the most significant developments are happening in automotive injection moulding right now. "Utilised for Advanced Driver Assistance systems, LSR is being used for safety critical applications," says Henrik



Below: Sumitomo (SHI) Demag's Intellect S machines have the precision and repeatability necessary for LSR moulding



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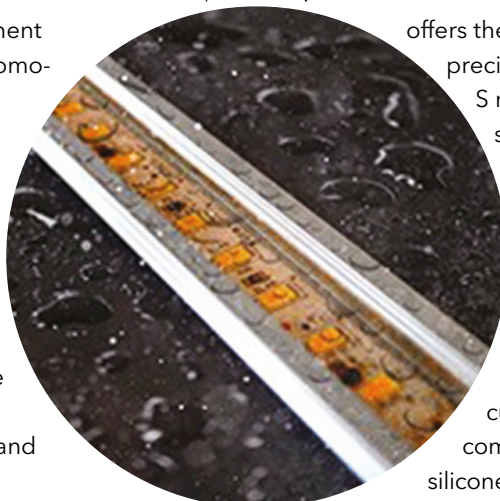
Right: Dow has developed Dowsil EI-2888 primerless silicone encapsulant, an optically-clear silicone for professional LED lighting that cures at room temperature

Langwald, Business Development Director Automotive. "For automotive, this includes new light concepts for vehicle headlights. These LSR active safety features, such as glare-free headlights, are considered to be highly innovative. The future development of autonomous vehicles will also prompt demand for more integrated LSR electronic components under the hood and within the vehicle interior.

"LSR involves using thinner, more durable and safer materials and integrating electronics, mechatronics and optics. The reason why LSR works so well for automotive applications is the material is weather and UV resistant, can withstand high and low temperatures, and dampness. LSR also enables manufacturers adopting this technology to achieve component geometries and technical features not previously possible, such as moulding microstructures on the surface of an LSR headlight."

Moulding LSR requires greater precision and process stability. "Machines with direct-drive servo motors, including the IntElect series, are designed to achieve extremely precise shot control with the low-viscosity material," says Langwald. "Units can be modified with a special screw geometry and non-return valve (activeLock) to achieve high repeatability with the precision LSR requires. Being able to combine LSR with technical plastics to create one fully bonded component is another exciting development. It will be feasible to combine two, three or more individual materials into one seamless, robust component, which offers vehicle designers huge opportunities. For LSR applications, the high precision IntElect range

PHOTO: DOW



offers the perfect solution in terms of precision and repeatability. IntElect S machines boast injection speeds of up to 500 mm/s. The standard IntElect line goes up to 200 mm/s."

Dow has developed Dowsil EI-2888 primerless silicone encapsulant, an optically-clear silicone for professional LED lighting that cures at room temperature. The company says that the advanced silicone technology provides good optical performance without compromise

and offers unique rheological properties for use with light fixtures in a variety of shapes and forms. Designed for explosion-proof and high ingress protection-rated luminaires, the company says that Dowsil EI-2888 is also cost-effective to buy and use as its patented composition does not contain platinum – unlike other silicone solutions currently available on the market.

"LED luminaires in harsh environments need protective materials that are reliable, easy to apply, and that provide robustness of cure," says Konstantin Sobolev, Strategic Marketing Manager for Dow. "Dowsil EI-2888 primerless silicone encapsulant eliminates a time-consuming processing step and reduces waste that can occur if curing is compromised by surface contaminants or moisture. This low-viscosity silicone also dispenses readily and adheres reliably without sacrificing optical properties. Dowsil EI-2888 is an excellent choice for many professional applications, including explosion proof lighting, outdoor displays, and flexible and rigid LED strips."

A two-part protective material with a 1:1 mix ratio, Dowsil EI-2888 cures at room temperature with optional heat acceleration. The UL 94 compliant, 100% polydimethylsiloxane (PDMS) silicone provides even curing and is insensitive to inhibition, a typical issue for platinum catalyst, and material reversion, a traditional problem in enclosed spaces at high temperatures. It can be applied with automated static or dynamic metered mixing, manual mixing, or with flow, pour or needle dispensing equipment. The self-priming encapsulant adheres to a variety of substrates and supports the design of innovative LED luminaires in IP-rated enclosures.

Four thermo-optical resins from **SABIC** have been added to the materials database of the **Zemax OpticStudio**, the industry-standard in software for designing optical systems. These

Below: Four thermo-optical resins from SABIC have been added in the materials database of the Zemax OpticStudio, the industry-standard in software for designing optical systems

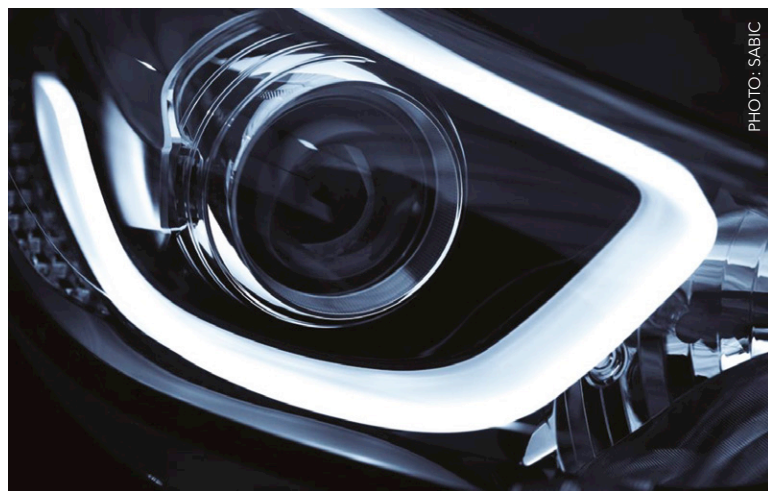


PHOTO: SABIC

high-performance materials – including two grades of high-temperature Lexan CXT polycarbonate copolymer, an Ultem polyetherimide (PEI) resin and an Extem polyimide resin – are among the first resins to be added to OpticStudio, giving designers of optical sensors and lenses new and innovative material choices beyond glass and epoxy resins.

SABIC says that the four thermo-optical polymers now listed in the Zemax OpticStudio database are well suited to the demands of optical component miniaturisation and address the challenges of integrating extensive functionality into limited space. Lexan CXT 17 and Lexan CXT 19 PC copolymers can deliver a balance of high-temperature resistance, high flow and excellent colour stability under extreme moulding conditions. The two copolymers have a high refractive index over 1.6 and high transparency in the UV-visible spectrum range. Ultem 1010 PEI resin can offer inherent flame retardance, high strength and dimensional stability, high light transmittance in the infrared spectrum range and the ability to withstand a broad temperature range of -40 to 180°C. Extem XH1015 polyimide resin can provide

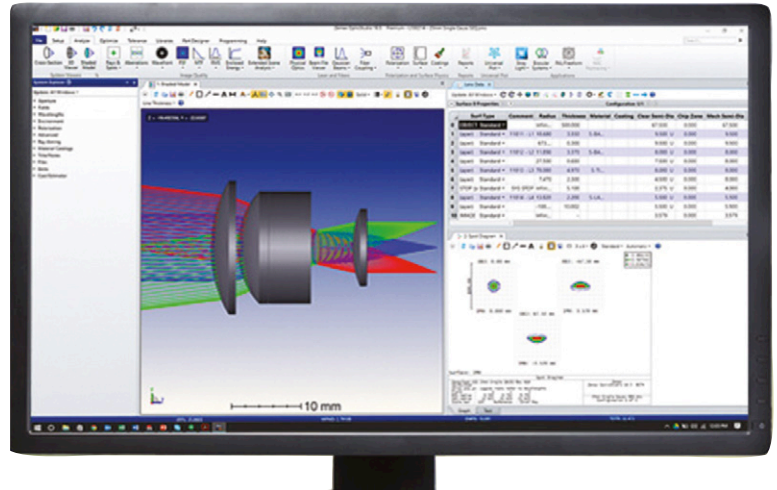


PHOTO: ZEMAX

extreme high-temperature resistance and high flow for miniaturised, complex or thin-wall parts.

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Above: Zemax OpticStudio has a growing thermoplastics database for designers of optical systems

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The injection moulders' guide to 2019

Part 1: Materials

The world's biggest and most international plastics trade fair opens in Dusseldorf in Germany next month. K2019 is the place to see the latest innovations in plastics materials and processing but it is a big event that's best approached with a plan - our pre-event coverage aims to help you get the most from your time there.

This month we take a look at some of the materials developments that are likely to be of interest to injection moulders. Over the next seven pages we provide details on some of the newest developments in polymer resins, compounds, TPEs, composites and masterbatches. Next month our spotlight turns to machinery and equipment.

K2019 will be a big show. The previous event in 2016 attracted 3,285 exhibitors and set a new attendance record of 232,053 (up by 5.5% on the 2013 number). The mood among visitors back then was really positive - the plastics industry had been going through a seven-year investment boom.

The picture for 2019 is quite different: global markets are slowing, protectionist economic policies are emerging, the impact of the UK's departure from the EU remains unclear, the automotive industry is facing a technological upheaval, plastics are finding themselves in the environmental firing line.

Against such a background, it is no surprise that machinery makers have dialled down their expectations - the VDMA (which represents German machinery manufacturers) is forecasting at least a 10% decline in production value across its members for this year, reversing a decade of growth. That said, the K show has always been a shop window for the very latest technologies and a place where business is done, whatever the prevailing market conditions. That is likely to remain the case for K2019.

If you are planning to attend the show but are yet to finalise your travel and accommodation, it is not too late. But you should act fast. There are some useful weblinks at the foot of this page and plenty more in the visitor information article in our July-August edition (pages 41-43) that may prove helpful.

The *Injection World* and AMI Magazines team will be at the show for the full eight days and will be gathering information for our post-event coverage in the November-December edition. We will also be reporting on the biggest news and innovations as they happen via our @PlasticsWorld feed on Twitter. If you want to be sure you keep in touch with developments join the more than 20,000 people already following us.

You may also be able to catch up with our editors and sales team on the AMI stand at the show - you can find us on Stand C11 in Hall 7. We will have information about our magazines, conferences, databases, consulting services and our new North American and European Expos available. Some of our industry experts will also be giving daily presentations covering polymers, compounds, masterbatch and recycling. You can learn more about those here https://go.ami.international/book_ami_k2019demo/

Dates: 16-23 October 2019

Venue: Messe Dusseldorf, Dusseldorf, Germany

Hours: 10:00-18:30 daily

Tickets: One-day €75, three-day €155 (€49/€108 online).
All include free local transport and on-site wifi

Organiser: Messe Dusseldorf

Website: www.k-online.com

Use the following links to go direct to essential show information:

K2019 hotel booking - <http://bit.ly/k2019hotel>

K2019 online ticket purchase - <http://bit.ly/K2019tickets>

K2019 exhibitor search - <http://bit.ly/K2019exhibitorsearch>

K2019 iOS/Android apps - <http://bit.ly/K2019mobile>



Right: The carbon fibre-based compounds from Albis subsidiary Wipag highlight the group's sustainability agenda

Albis is showing the expanded range of sustainable materials it produces itself and distributes for polymer majors. Some of these are LyondellBasell's Circulen and Circulen Plus product families. These are low density bio-based PPs and PEs with renewable hydrocarbon bases, recovered from sustainable bio-based resources such as used and residual oils. These are approved for use in the manufacture of food packaging. Quality Circular Polymers post-consumer recycling products are part of LyondellBasell's existing product families, Moplen PP and Hostalen PE, and are oriented towards high quality applications, including cosmetics and suitcases.

Albis' Altech Eco range are technical compounds that comprise up to 100% post-industrial fibre and polymer raw materials. Also on show will be the carbon fibre-based compounds from Albis subsidiary Wipag. WIC-PP and WIC-PA products feature "excellent" rigidity, pressure and tensile strength, yet have low density, and are suited for all types of lightweight construction.

In the medicare arena, Albis has expanded its product portfolio with Alcom Med, a range of tailor-made compounds for healthcare applications such as medical products, pharmaceutical packaging, and diagnostic applications. These products are based on a variety of different polymers and include pigmentation as well as a wide range of fillers.

➤ www.albis.com

AMI is launching new data services at K2019. The company (publisher of *Injection World*) has a database of global plastics processors, which has been assembled over 30 years and includes verified information for more than 20,000 named production sites. At its K stand, it will promote new data subscription services and demonstrate a suite of interactive tools to support online analysis of critical market information.

Below: Electric mobility is a highlighted area for BASF at K2019



With advanced mapping capabilities and online access, AMI said a number of its larger clients are already taking advantage of the new web-based search and analysis tool. A range of options is also available for smaller clients that may require more targeted access to data.

As well as demonstrations of the new data tools, visitors to the AMI stand will also be able to join daily speaker sessions, where AMI polymer experts will cover topics including plastics recycling, compounding and masterbatch.

➤ www.ami.international

Ascend Performance Materials has developed new PA66 resins and compounds which it will show at K2019. Among these are high-heat and long-chain PAs, additional flame-retardant grades of its Vydyne PA66, and materials with recycled content. At a pre-K media event in June, company executives said it now has five PA grades that have recycled content and it is aiming to increase the number by at least another four grades. The company also sees opportunities for PA66 in electric vehicle applications, for example battery trays and housings, connectors and sensors.

➤ www.ascendmaterials.com

BASF is highlighting electric mobility at K2019 and how its materials can meet the needs in many applications. In terms of safety, flame retardant plastics are vital for high-voltage components. Special PA and PBT grades are available from BASF that meet the highest requirements in flame retardance, colour stability, mechanics, and electric insulation. Housings that contain high-voltage electric components must be electrically shielded to prevent compromising the surrounding area. Metal coatings on the plastic housing parts are one of the possible solutions that BASF is pursuing.

In autonomous driving, BASF says it has made a significant contribution to a number of sensitive electronic sensor technologies with its unique portfolio of hydrolytically resistant PBT grades. For functions such as distance controllers BASF offers

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Right: Borealis is demonstrating its position in plastics recycling, including materials produced by its recycling subsidiary MTM

radar-optimised plastics used for radar transmission and absorption that increase the accuracy of the sensors, thereby improving the functionality of the automated vehicle with greater cost efficiency.

➤ www.basf.com

Bieglo will display a range of high temperature PEEK compounds, including a full range carrying FDA and EU food contact approvals. With its resistance to alkaline cleaning products and high temperature steam cleaning, PEEK is a popular choice for food processing machinery applications. Bieglo offers self-lubricating versions for bearings and gears, as well as coloured and detectable grades. The company can also offer PPSU options for food processing. These grades are translucent, sterilisable and can withstand continuous operating temperatures of up to 160°C.

➤ www.bieglo.com

Borealis is introducing a new plastics recycling technology, Borcycle, and at K will show the first compound made of recycled polyolefins that has been developed with the technology. Borcycle MF1981SY is a 10% talc-filled compound with more than 80% recycled content and is intended for use in visible appliance parts. It offers an ideal balance between stiffness and impact, according to Borealis.

The group is also showing recycled grades in its established Purpolen range. Purpolen PP Y40 is a material with higher and improved flowability, aimed at pails, thin-wall packaging and appliance parts. Design for recycling is a related focus on the Borealis K2019 stand. In this context, it will show



PHOTO: BOREALIS

how Daploy HMS PP can be used to replace current difficult-to-recycle food service cups. Borealis is the exclusive materials development partner for UK-based Bockatech, which has developed EcoCore foaming technology for moulding PP cups that can be reused many times and are then recyclable in PP packaging waste streams (see *Injection World's* March 2019 issue).

Borouge will be sharing the K2019 stand with Borealis and will have "new energy vehicles" as a focus. The company said Fibremod CB201SY, a carbon fibre reinforced PP, was selected to produce the centre console carrier of the ES8 SUV made by Chinese car maker NIO because of the compound's stiffness, strength and weight reduction. Borouge intends to show the part on the K2019 stand.

➤ www.borealisgroup.com

➤ www.borouge.com

Cabot will present its full range of specialty carbon blacks, black masterbatches, and conductive



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compounds and concentrates, with the latter category bringing together its expertise in graphenes and carbon nanostructures. In the engineering sector, it will show its Cabelec conductive compounds, Vulcan conductive carbon blacks and Plasblack line of black masterbatches for engineering plastics. The company will also introduce a new black masterbatch range formulated to provide enhanced covering power to over-colour mixed recycled plastics.

➤ www.cabotcorp.com

Right: DSM's Arnitel TPE is used in non-pneumatic tyres, that are not supported by air pressure

Clariant will use K2019 to highlight partnership work to "create a more sustainable plastics industry through a 'Symphony of Collaboration' ". It is launching a company-wide initiative specifically focused on plastics recycling. One of these partnerships is with the Finnish oil refining company, Neste, which reuses fat residues and discarded cooking oils as feedstock. Clariant has been exploring opportunities to use renewable hydrocarbons, derived from this waste. Details will be announced at K, including new products for plastic applications based on mass-balance certification for usage of renewable polyolefins.

With Tomra, its partner in near infrared (NIR) scanner technology, Clariant has developed new colorants for the black coloration of plastics that can be identified by NIR sorting devices at recycling facilities. This new range of black colorants can be used for various polymers (including polyolefins, PET, PA) and applications such as packaging and E&E, it said.

➤ www.clariant.com

Below: Clariant has developed new NIR-detectable black masterbatch

Covestro will present a new interior concept for future mobility as part of its focus on digitalisation

at K2019. The company said the car of the future will be fully networked and seamlessly integrated into everyday life. Interior design features include surfaces with a decorative look and touch, integrated ambient lighting, infotainment systems and advanced seating concepts. The display shows how Covestro's Makrolon polycarbonate and blends play an important role due to design freedom, mechanical stability and low weight. The materials enable a range of glass-like surfaces and colours, which are important for the integration of displays, sensors, cameras and ambient lighting systems. Also featured are

Maezio continuous fibre-reinforced thermoplastic composites production of particularly thin-walled parts.

Covestro will also discuss how it is incorporating digital technologies and processes into production, the supply chain, R & D, at all customer contact points and in new business model development.

➤ www.covestro.com



PHOTO: DSM

Dow will present on its K2019 stand case studies and prototype examples across four 'domains'. It says these show "how a collaborative approach to materials science can allow us to protect precious goods, build more effectively, move more efficiently and care more holistically". The company will exhibit under its new brand platform called Seek Together, which it has launched following its demerger from DowDuPont. More than 100 prototypes will be on display to illustrate current and future application potential.

➤ www.dow.com

DSM is showing its materials in a wide variety of applications at K2019. In the growing electric vehicle sector, the company said its conductive materials enable the replacement of metal enclosures, with shielding efficiencies of around 40-60dB of plastic thickness, which protect from EMI, and can lead to weight reductions of up to 50%.

DSM has developed Akulon RePurposed PA, which contains recycled polyamide from used fishing nets. In a project with surfboard brand Starboard the material is used to produce fins, fin boxes, standup paddleboard pumps, and other structural parts in surfboards. The product can be applied in many other applications and is specifically targeted at the sports and leisure market.

The group will demonstrate the use of Arnitel



PHOTO: CLARIANT



TPE in non-pneumatic tyres, that are not supported by air pressure. Arnitel's suitability stems from a combination of flexibility, high temperature resistance, strength and processing characteristics.

In additive manufacturing, DSM will show a Ducati motorbike airflow chamber that uses 10% carbon-fibre filled Novamid in the FFF (fused filament fabrication) process. Another example is a car tail light enclosure produced with the SLS process using Arnite PBT powder.

➤ www.dsm.com

Eurotec will exhibit its engineering thermoplastics for a wide range of industries including automotive and transportation, electrical/electronic, home appliances, sports and leisure, safety equipment, garden and power tools, construction and agricultural equipment, furniture industries, medical industry, defence and signalisation. Its materials include PA6, PA66, PA6.10, PPA, PBT, PET, POM, PPS, PEEK and PEI. Its ranges include thermally and electrically conductive compounds.

➤ www.eurotec-ep.com

Evonik's display at K2019 includes the latest additions to its polymer and additive ranges. In the high performance polymer sector, the company will mark the 40th anniversary of its Vestamid PA12 elastomer (PEBA) with the introduction of a new grade offering considerably improved levels of transparency and gloss. The additive display includes the Tegomer range of additives, as well as the Accurel family of porous carriers that allow liquid additives to be easily handled in compound formulations. Latest additions to the additive product line include flame retardants and odour absorbers.

➤ www.evonik.com

Feddersen Group companies exhibiting at K2019 include compounder **Akro-Plastic** showing its new product developments. It has expanded its



PHOTO: AKRO-PLASTIC

**Citos seat system
made of Akro-Plastic's
Akromid B28 GF 25 9
compound by the
company Franz Kiel**

portfolio of PPA compounds from those based on PA 6T to new ones based on the homopolymer PA 9T (brand name Akromid T9). These are particularly characterised by lower water absorption in comparison with PA 6T and thus more consistent mechanical performance. Initial tests also show better flowability and faster crystallisation behaviour, which will facilitate the very complex production of PPA compounds, says Akro-Plastic.

For the public transport sector, the compounder has expanded and improved its portfolio of halogen-free flame-retardant compounds. In long fibre reinforced compounds, the company has been working with Feddem on compounds that show a factor of 2-3 times higher tenacity than short fibre reinforced compounds with improved ageing stability and creep properties. Particularly noteworthy is Akromid B28 LGF 40 1 L: a chemically coupled blend of PA 6 and PP, which flows much better than a pure PA 6 with 40% glass fibre reinforcement and offers conditioned strengths higher than a 50% reinforced PA 6.

Other companies in the group are distributor KD



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Right: Ineos Styrolution has been active in finding solutions for recycling PS

Feddersen, toll compounder PolyComp and engineering service provider M.TEC, which became part of Feddersen Group in June 2018.

➤ <https://akro-plastic.com>

➤ <https://kdfeddersen.com>

Hexpol TPE says its motto at K2019 is "Soft Safe Sustainable" reflecting what the company does and the products it makes, plus how it does it in a sustainable manner. At the show, it will present new products designed to meet increasing demands for product safety and sustainability, with applications from the consumer, toy, automotive, construction and medical markets. Hexpol TPE's product innovations include: Dryflex Green soft plastics from bio-sources, Dryflex Circular TPE compounds with recycled content and Dryflex Interior TPEs that minimise emissions from VOCs for automotive interior applications.

➤ www.hexpoltpe.com

Huntsman will introduce a range of polyurethane-based 3D print material systems aimed at prototyping and custom production applications in the footwear and sports and leisure sectors. The Iroprint materials are soft, flexible formulations available in systems suitable for all three main 3D print technologies - stereolithography (SLA), high speed sintering (HSS) and fused filament fabrication (FFF).

➤ www.huntsman.com

Ineos Styrolution said a major theme for the styrenics producer at K2019 will be demonstrating the recyclability of polystyrene. The company has a number of projects involving both chemical and mechanical recycling of PS. Its work in depolymerisation led the company to announce in April it had produced lab-scale quantities of general purpose PS from 100% recycled styrene monomer.

At K2019 Ineos Styrolution will show at least two grades of Terluran ABS with 20-30% recycled ABS content, said executives at a pre-K media event in June. Other new products will include a high-flow ABS material for thin wall applications and appliances including vacuum cleaners.

➤ www.ineos-styrolution.com

Korsini will be showing its expertise in in-mould labels at K2019. The labels it produces are de-

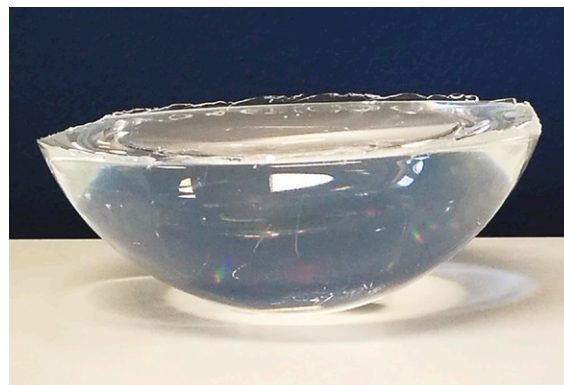


PHOTO: INEOS STYROLUTION

signed for a wide range of markets, such as consumer and industrial packaging. It also produces durable and barrier IML labels.

➤ www.korsini.com

Kraiburg TPE will place the main focus of its display on low emission thermoplastic elastomers. Two new compound series will be shown for applications where low migration is a top priority, such as valves and seals for closures for food and beverage applications coming into direct contact with fat. The company will also present examples from its ultra-low VOC emission range of TPEs for interior automotive use, as well as its custom-engineered thermoplastic hybrid products, which offer enhanced chemical and thermal resistance and are claimed to close the gap between TPEs and traditional elastomers. It will also introduce a line of UV-resistant TPEs for exterior automotive applications that provide adhesion to ASA, PMMA and EPDM.

➤ www.kraiburg-tpe.com

Lanxess said its High Performance Materials (HPM) business unit will be presenting a wide range of new

PA and polyester products relating to electric mobility. New HPM materials include

orange, heat-stabilised Durethan PA and Pocan PBT compounds for high-voltage applications. These include materials that prevent electrical corrosion upon contact with live metal parts, plus and halogen-free FR materials for components such as battery cell holders and cover plates.

On display will be a durable seat shell and a highly integrated front-end carrier made from Tepex, the group's composites technology, both of which exhibit an "excellent crash resistance," said Lanxess.

For connectors and switches in smart home

Right: Lanxess will show a durable seat shell part made from its Tepex composites

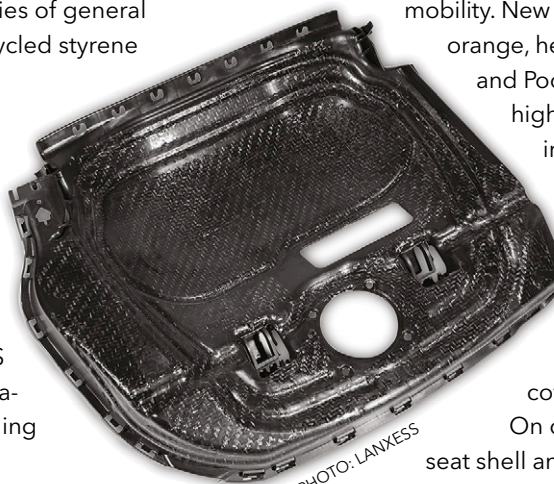
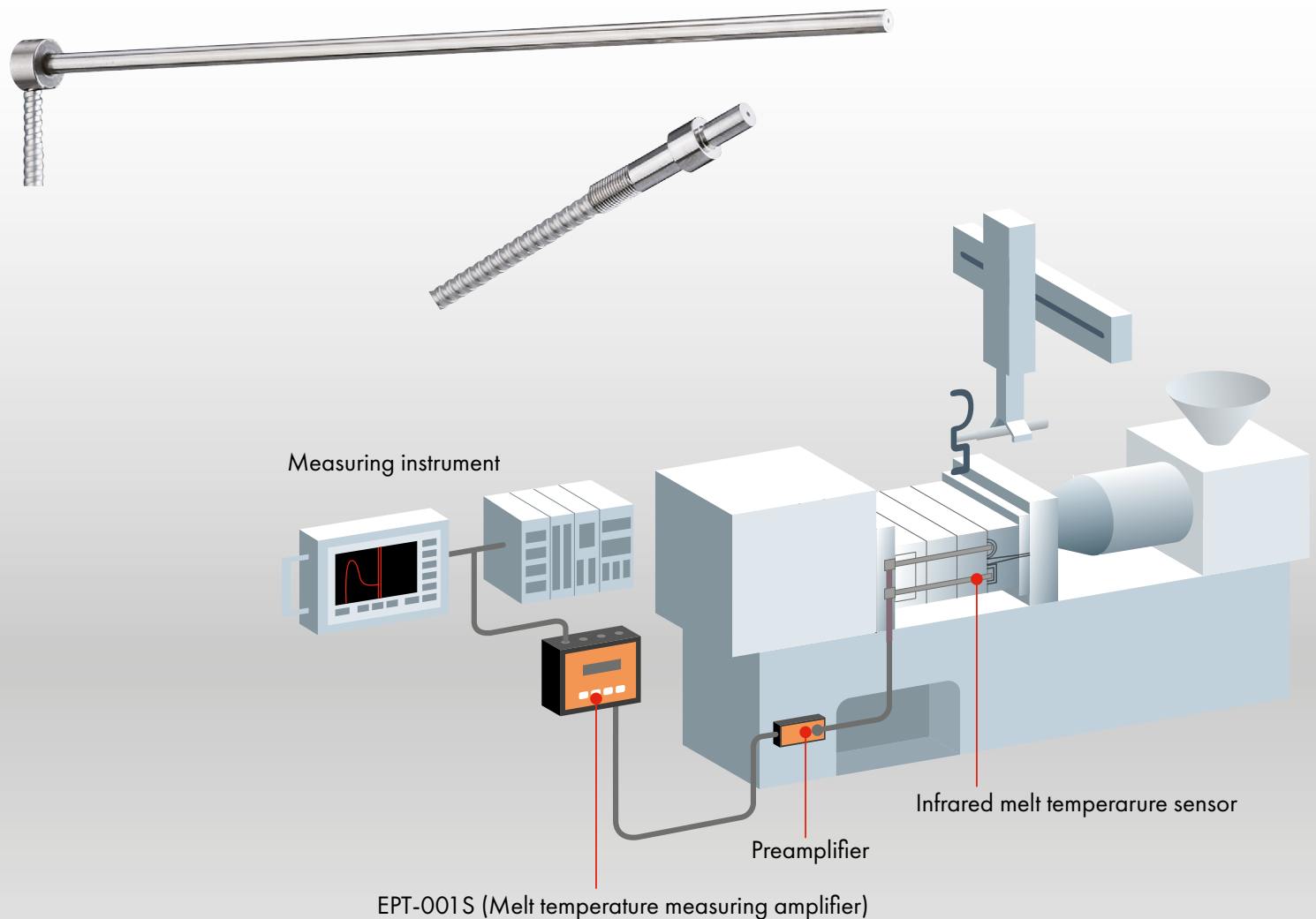


PHOTO: LANXESS

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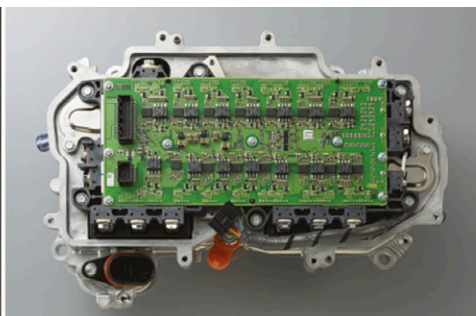


PHOTO: POLYPLASTICS

Above:
Polyplastics
will show ETP
materials for
demanding
applications

systems, Durethan BG60XXF will be shown in switch holders in the Living Now product range from Bticino, an Italian manufacturer of electronic components. Thanks to the compound, the component meets extremely high standards of planarity, dimensional tolerance and rigidity, the company said.

➤ www.lanxess.com

Plastika Kritis will show its wide range of colour and additive masterbatches at K 2019, along with its recycled and extruded products. The group's Kritilen masterbatches include colour, black and white masterbatch products, and it offers a colour matching service for customised colours. Its filler masterbatches are based on calcium carbonate and talc. The group also produces garden furniture compounds containing high loadings of calcium carbonate or talc, often with other additives and/or colours.

➤ www.plastikakritis.com

Polyplastics and its subsidiary **Topas Advanced Polymers**, which manufactures cyclic olefin copolymers (COCs), will jointly showcase their materials at K2019. Polyplastics will discuss the recent launch of Duracon POM grades for the production of injection moulded automotive fuel system components.

For electric vehicle applications, the company has developed new Duranex PBT and Durafide PPS materials, for engine peripheral parts such as power control units, which have high insulating properties, lower water absorption, and meet the demands of harsh operating conditions.

www.polyplastics.com

Repsol's main features at K2019 will focus on its sustainability activities, including the first products from its Reciclex line of olefins with recycled content plus its Zero chemical recycling initiative. Repsol 50RX2805 is an LDPE containing 50% post-consumer waste that is formulated for production of films for secondary packaging applications such as collation. The Zero project aims to use pyrolysis oils obtained by chemical recycling of plastic waste. The company says it has incorporated these products into its petrochemical plant at Puertollano in Spain on an experimental scale.

➤ www.repsol.com

SABIC is highlighting its commitment to circular solutions and reducing plastics waste under the theme of "Making a world of difference together". The group said it will be addressing global trends through the use of bio-renewable and recycled feedstock, and showcasing product solutions for its customers in multiple industries in the context of recyclability, durability and optimal reuse.

SABIC products of interest for injection moulding visitors to its K stand include PP Ultra Melt Strength resin, which is a completely new generation of melt strength polypropylenes. SABIC PP-UMS has a melt strength of 65 cN and above, enabling an unprecedented level of lightweighting, according to the company. It will also highlight its Lexan PC and Valox PBT/PC materials for applications in electric vehicle supply equipment, such as attachment plugs, couplers and conductors.

➤ www.sabic.com

Right: SABIC PP-UMS
has a melt strength of
65 cN and above,
enabling an
unprecedented
level of lightweighting,
according to the company

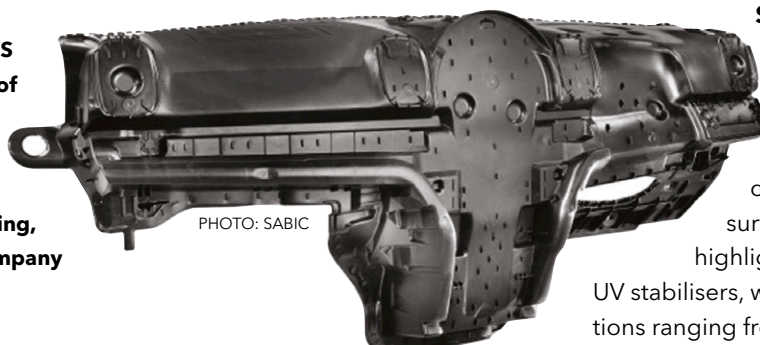


PHOTO: SABIC

Solvay will introduce a new high temperature PEEK resin at K2019 as well as exhibiting its latest line of LFT products, which includes a recently developed grade capable of forming a high quality surface. In the additives sector, it will highlight its Cyasorb and Cyasorb Cyxtra UV stabilisers, which are formulated for applications ranging from polyolefin agricultural films and

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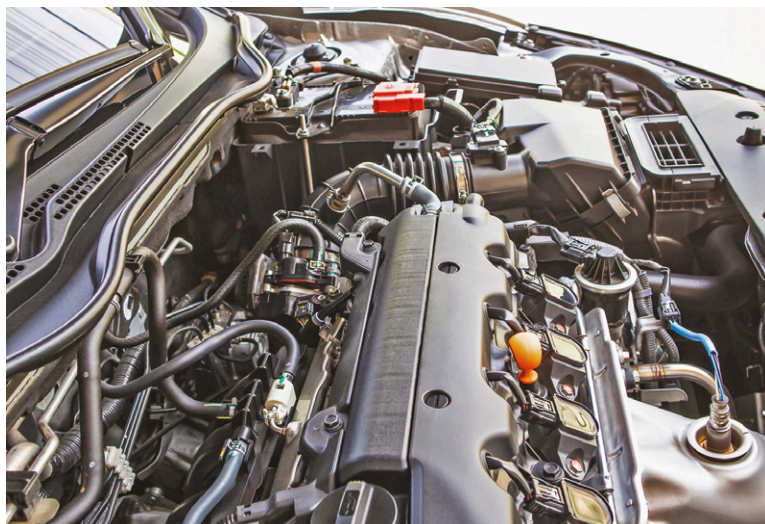
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Above: New Teknor Apex Creamid P PA6 grades are targeted at demanding structural applications

Right: Products from Wacker's new 3D silicone printer ACEO Imagine Series K2 will be displayed

Right: Victrex has received IATF 16949 certification for its fully integrated high-precision automotive PEEK gears

automotive components through to PTO and PET photovoltaic backsheet films.

➤ www.solvay.com

Teknor Apex is launching its Creamid P Series of PA 6 compounds, which absorb less water than standard PA6 which leads to superior property retention after conditioning. The company says the compounds absorb nearly one-third less water at saturation than standard grades, provide 15-25% improved tensile properties in the conditioned state, and exhibit higher flow and "excellent" surface characteristics, including in highly glass-filled formulations.

At K2019 Teknor Apex will introduce the first two Creamid P compounds with 30% and 50% glass fibre content. Dry as moulded, these compounds exhibit about 80% reduction in water uptake after 24 hours as compared to standard PA 6, and about 30% lower upon saturation, said the company. In the conditioned state these new grades, Creamid P2H7G6 and Creamid P3H2G10, exhibit higher tensile elastic modulus and strength at break.

➤ www.teknorapex.com

Trexel will be presenting its TecoCell range of chemical foaming agents. Offered alongside the company's established MuCell physical foaming system for injection moulded parts, the TecoCell products are claimed to offer premium chemical foaming performance at a low price. The company claims the patented technology, which uses nano-sized (<0.08 micron) CaCO₃ particles,

produces a fine cell size foam with a higher surface quality than can be achieved with conventional chemical foaming agents.

➤ www.trexel.com

Victrex will show gears made from its high performance PEEK and PAEK polymers at K2019. Its gear design and manufacturing facility in Grantsburg, US, recently received IATF 16949 certification, proving that the necessary systems and capabilities in line with Tier1/OEM needs are in place. Victrex PEEK has been used in auto gears for decades but since 2015, Victrex has extended its material expertise to the design, development and manufacture of gears, to offer a fully integrated approach. A major European car manufacturer has already taken advantage of the company's gear design approach, it said.

➤ www.victrex.com

Wacker said its focus will be on liquid silicone rubber grades that, due to reduced volatiles content, do not necessarily require post-curing. The company's Elastosil LR 5040 grade will be at the centre of its injection moulding demonstration, in which food-contact parts will be produced.

Also on the Wacker stand will be the new 3D silicone printer ACEO Imagine Series K2. The latest printer generation is capable of multi-material printing and has novel auto-control technology and several technical enhancements in terms of freedom of design and precision. The printer measures the silicone layer applied after each printed layer and compares it with the target value specified in the CAD model.

➤ www.wacker.com

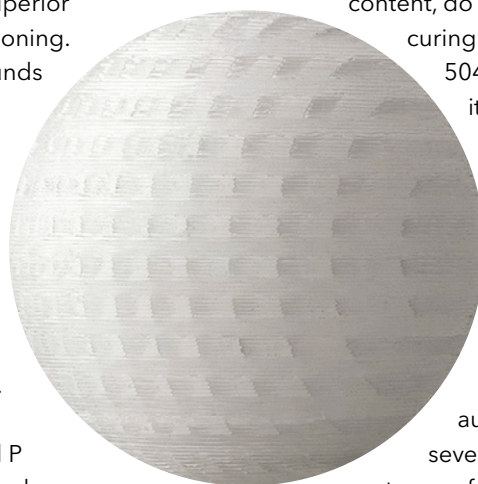


PHOTO: WACKER

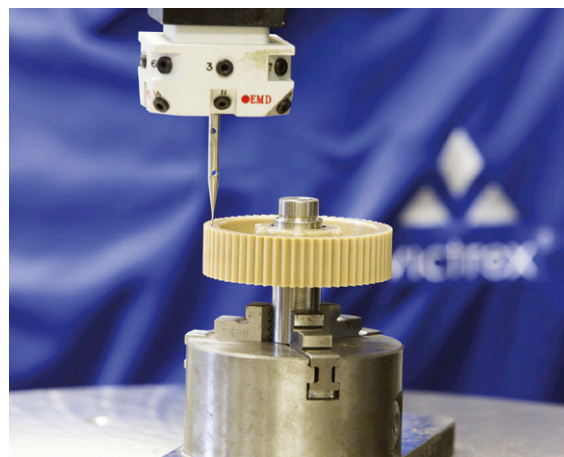


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Plastics that can handle the heat



High temperature thermoplastics are increasingly replacing metals in automotive, aerospace, electronics and domestic appliances. Peter Mapleston reports on developments in PA, PPA, PPS, PEEK and other polymers

Injection moulders and specifiers may be forgiven for not knowing which way to turn when it comes to choosing thermoplastics with resistance to high temperatures. In recent years, portfolios of high temperature polyamides (most but not all of them polyphthalamides, PPAs), polyphenylene sulphides (PPS), polyaryletherketones (PAEKs, of which the most famous is polyetheretherketone, PEEK), and polyetherimide (PEI), have all grown substantially, as material suppliers work to cater for growing demand.

Interest in high-temperature-resistant thermoplastics (HTPs) is coming from all directions. That's the view from Brett Weishalla, Senior Product Development Engineer at major compounder **RTP Company** in Winona, MN, USA. "While the manufacturers in the automotive, aerospace, oil and gas, electronics, consumer goods, and semi-conductor markets have been long-time users of HTPs, particular segments - such as electric vehicles or e-cigarettes - are quickly developing into market spaces of their own," he says.

At **Conventus Polymers**, an up and coming specialty thermoplastics distributor and formulator based in Parsippany, NJ, USA, company president John Jorgensen says HTPs typically offer ancillary benefits in addition to temperature resistance, such as inherent flame resistance, excellent flame,

smoke, and toxicity (FST) properties, superior chemical resistance, good creep resistance, very high purity, and many others.

"HTPs continue to increase in popularity as options for metal replacement in many industries with critical applications, including automotive, oil and gas, healthcare, semi-conductor, electrical, fluid handling, membrane/filtration, food service, and aerospace to name a few," Jorgensen says.

BASF is among leading polymer producers innovating to respond to this increase in popularity. It has launched no fewer than three new families of PPAs - polyamides with extra high temperature resistance thanks in part to their semi-aromatic nature - since just before K2016, explaining that "this fundamental market challenge cannot be solved by a single material".

The company's PPA portfolio, which comprises some 50 compounds, is now based on four polymers: Ultramid T KR, a PA6T/6, which BASF has been selling since the 1990s; Ultramid Advanced N, a PA9T unveiled at K2016; Ultramid Advanced T1000 (PA6T/6I) introduced at Fakuma 2018; and Ultramid Advanced T2000 (PA6T/66), which debuted at Chinaplas 2019.

At the launch of Ultramid Advanced T2000 in May, Abdullah Shaikh, head of the global PPA team

Main image:
Interest in HTP materials is coming from varied markets and applications

Right: PPAs chalk up more success in connectors

at BASF, said the product “is the ideal solution for parts that require high, constant stiffness and strength over a broad temperature range in combination with resistance to heat and humidity as well as optional flame-retardant (FR) properties.”

According to BASF, the latest PPA shows improved impact strength on a par with standard PA66 and a lower water uptake than standard aliphatic polyamides, resulting in high dimensional stability. Its high melting point (310°C) and heat deflection temperature of over 280°C (HDT-A) make it suitable for lead-free soldering without part deformation. Flowability is “significantly higher than that of other high-temperature polyamides without compromising flexibility or toughness”.

Within the T2000 family, BASF has developed a special range of FR grades reinforced with 30% to 40% glass fibres and with UL 94 V-0 rating available for all colours. In addition, there are several grades with reinforcement levels ranging from 30% to 50% glass fibres and improved impact resistance, available both as uncoloured and laser-markable black. Different heat stabilisers are available.

Also working on PPAs is **RadiciGroup High Performance Polymers**, which has developed several grades under the Radilon Aestus brand. Once again, the materials are less affected by humidity than standard polyamides; they also have higher resistance to hydrolysis, as well of course as higher melting temperatures. The Radilon Aestus T range complements other products from RadiciGroup High Performance Polymers based on PA 6 and 66.

The company’s marketing emphasis appears rather different from BASF’s. Global Marketing Manager Erico Spini cites applications for Radilon Aestus T1 RV 300 FC and Radilon Aestus T1 RV 400 FC in food-contact products suitable for use at temperatures of up to 270°C. Products aimed at hot water plumbing include Radilon Aestus T1 RV 300 RKC, T1 RV 400 RKC, and T1 RV 450 RKC, while Aestus T1 RV330RG is suitable for components in

Below: Kitchen tools that need to resist high temperatures are being made in PPA



PHOTO: RADICIGROUP



PHOTO: BASF

contact with automotive engine coolants.

Expanding options in PA9T

Last year, **Kuraray** expanded its Genestar PA9T E&E grade portfolio with flame-retardant (V-0) halogen-free 30% glass reinforced grades (see *Injection World* September 2018). This year, it is highlighting the fact that it is removing the last barriers for use of the grades in E&E applications, by finalising the necessary UL registrations, such as RTI values.

“Since Genestar PA9T grades are unique in combining a good processability with JDEC MSL 1 blister resistance, CTI [Comparative Tracking Index] over 600 V and a high weld-line strength, these benefits can finally be experienced by design engineers in Europe,” says Wim Dennison, Market Development Specialist with Eval Europe, Kuraray’s subsidiary in Belgium.

Dennison also points to a new “electro-friendly” 30% glass reinforced grade, G1300A-M42, which has improved toughness, developed to target more robust automotive connectors and parts in close proximity to electronic components. “When increased mechanical properties are prioritised over high flow as is normally desired for small E&E parts, this grade could be an exquisite fit,” he says.

Compounder **Akro-Plastic** has expanded its product portfolio of PPAs with Akromid T9, which is also based on PA9T. It notes that PA9T absorbs less water than other PPAs, so its Tg is less affected after conditioning (ending up at 100°C, down from 120-125°C, whereas other PPAs can lose around 40°C)

“Polymer producers usually design grades to balance properties for general purpose use,” says Conventus Polymers’ John Jorgensen. “Higher competition has led PPA producers to differentiate by developing specialty grades. The availability of specialty grades allows engineers to select formula-

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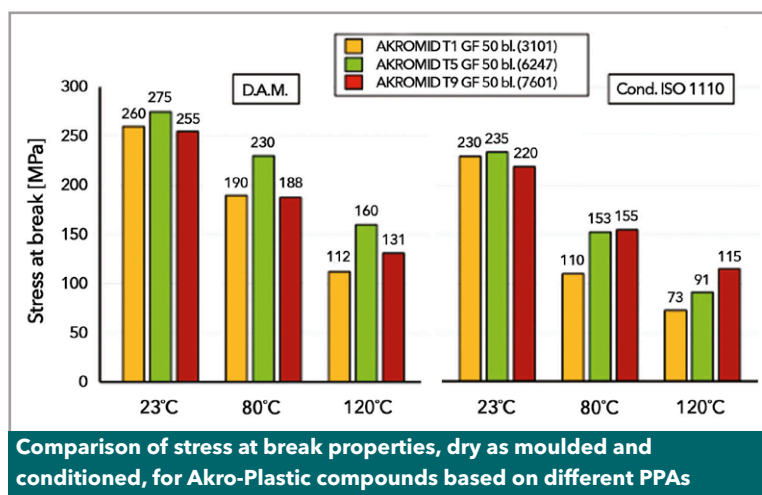


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Characteristics	Test mthod	AKROMID T1 GF 50	AKROMID T5 GF 50	AKROMID T9 GF 50
Humidity absorption [%]	70°C, 62% r.H. ISO 1110	0.9	0.8	0.4
T _g (dry) [°C]	DIN EN 11357-1	120-125	130-135	120-125
T _g (cond.) [°C]	DIN EN 11357-1	80	90	100
T _m [°C]	DIN EN 11357-1	310-315	320-325	295-300

Comparison of selected properties of different PPAs from Akro-Plastic



Comparison of stress at break properties, dry as moulded and conditioned, for Akro-Plastic compounds based on different PPAs

tions that better serve their unique set of requirements. This often results in improved performance and/or capabilities for the next generation of existing applications, and the design of new products addressing spaces previously out of reach.”

RTP’s Weishalla says that although new PPAs have expanded the potential operating environments and applications for PPAs, the trade-off between performance and economics “is a delicate balance. There will still be plenty of room for the more economical conventional grades in most applications.”

Enabling smaller connectors

In consumer electronics, most manufacturers of printed circuit boards (PCBs) have moved to surface mount technology (SMT), which exposes connectors to the high temperatures (sometimes as high as 280°C) of reflow soldering. At **DuPont**, marketing manager Christophe Paulo says that as phones and other devices become smaller but more powerful and sophisticated, PCBs must accommodate more connectors on the same or less real estate, driving the need for miniaturised, thinner-wall designs. Another connector challenge is reducing halide content in plastic materials to avoid post-soldering corrosion and improve sustainability.

“The shrinking size and increasing capabilities of electronics are driving demand for lighter, smaller and thinner-walled connectors that can withstand elevated temperatures, most notably in automotive

and consumer electronics,” he says. “Electric and hybrid vehicle batteries and wiring harnesses expose connectors to high voltages and currents, requiring robust materials. As more vehicle functions become electrified, new safety, navigation and infotainment capabilities are added and autonomous vehicle development continues, the industry requires connectors that can deliver high-speed, high-bandwidth and high-power signals to and from every sensor.”

Two recent high-temperature additions to DuPont’s portfolio of high-performance materials for connectors are Zytel HTNFR42G30NH, a glass-reinforced, bio-based, non-halogenated flame-retardant polyamide, and DuPont Zytel Plus 95 G35DH1 polyamide with proprietary Shield Technology to enhance heat-aging performance.

Zytel HTNFR42G30NH, which Paulo says is the first of a new family of high-heat materials, is aimed primarily at connectors used for SMT operations. The material meets the UL 94 V0 flammability rating at 0.4 mm and offers superior flow and a 600-V CTI. Connectors moulded in this material show no blistering at SMT reflow temperatures of 280°C. A combination of high flow and improved weld line strength gives designers greater flexibility to create miniaturized components such as multi-pin, fine pitch and low height connectors, he notes.

Zytel Plus 95 G35DH1 provides high performance – including high-temperature resistance – for less money than PPA and other high-temperature resins, Paulo says. Targeted for automotive connectors, this material also offers good flammability performance and resistance to road chemicals, hot air and hot oil. Its low-halide content, due to the organic heat stabilisation and additive system, improves reliability in electronic components.

“Continuous moulding trials with Zytel HTNFR42G30NH polyamide demonstrated lower machine corrosion compared to PA 9T and PA 4T based products, helping to reduce tool maintenance,” Paulo further notes.

DuPont continues to develop new products for its Zytel HTN family to keep pace with demands for higher-performing connectors across multiple industries, including appliances, lighting as well as



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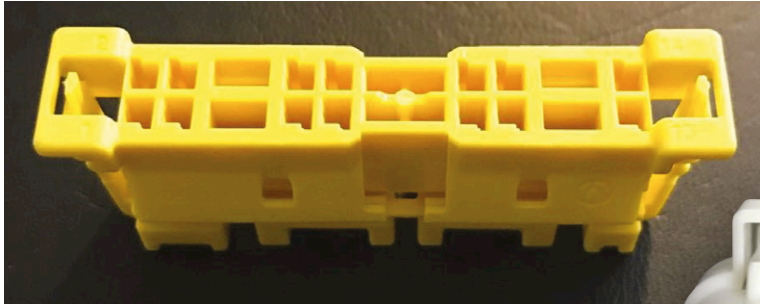
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PHOTO: DUPONT



Above and right: DuPont's Zytel HTNFR42G30NH and Zytel Plus 95 G35DH1 polyamide are well suited for use in a variety of connectors

automotive and consumer electronics.

Automotive engines have been relying on HTPs for a while now. RTP's Weishalla says that although electric drives change the types of parts that are required, the demand for high temperature resistant thermoplastics remains high, particularly for electric motors, battery systems, and mating connectors.

Hot and cold

Sun Chemical Advanced Materials (part of the Japanese DIC Corporation), recently commercialised DIC.PPS FZ-2140-T3 Black, a PPS that it claims is the new benchmark material to replace metal in heating and cooling applications. FZ-2140-T3 Black is optimised for automotive coolant applications, including thermal management modules (TMMs) and non-automotive applications, such as boilers and home heating systems.

"In the coming years, TMMs will be the biggest injection moulded PPS application worldwide, providing increased fuel efficiency and lower

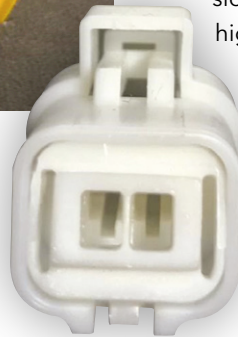
emissions," the company says. It notes that TMMs and other demanding heating and coolant applications require excellent resistance to automotive coolants; high mechanical strength, especially knit line strength; outstanding dimensional stability and low water absorption; high creep and fatigue resistance; and good weldability leading to high strength in welded joints.

"To achieve and surpass these requirements, the new 40% glass fibre, linear high-molecular-weight DIC.PPS FZ-2140-T3 Black grade exhibits over 85% retention of tensile strength and tensile knit line strength after 3,000 hours in coolant at 135°C, 200 MPa tensile

strength and 80 MPa tensile knit line strength at ambient temperature, and outstanding high strength in welded joints, shown by 71 MPa tensile strength in infrared welded plates."

At K2019, **Polyplastics** will also show the latest developments in its Durafide PPS. It says that for electric vehicle applications, it has developed new grades targeted for engine peripheral parts such as power control units (PCUs), to deliver high insulating properties, lower water absorption, and meet harsh operating conditions (-40°C to 150°C, up to 95% relative humidity).

Because of their chemical resistance and their ability to be moulded into complex parts with tight tolerances, PPS materials can be a good choice for consolidating parts in systems that operate high temperature environments, RTP's Weishalla notes. His company recently formulated a new PPS compound with the



High-heat polycarbonate for syringes

Covestro highlights the use of its Apec high-temperature polycarbonate in medical syringes. It says the market for prefilled syringes is currently experiencing strong growth - for example, in systems for the treatment of chronic diseases such as rheumatism.

"The design of such injection systems is primarily concerned with ease of use to ensure that the patient is reliably supplied with the intended dose of the active substance," says the company. The adapter for later screwing in the needle and the syringe cap plays a key role here.

With its Gx TELC (Tamper Evident Luerlock Closure), Gerresheimer is

offering an integrated solution which combines both functions in a single component and also enables tamper-evident protection of the active ingredient. The medical technology specialist chose Apec 1745 as the material for the adapter. The transparent adaptor can be sterilised using conventional methods such as gamma rays or ethylene oxide. "In addition, it is dimensionally stable and dimensionally accurate at high temperatures, so that the entire component does not warp after hot steam sterilisation at 143°C, for example," says Dr Wenzel Novak, Global Senior Director Business Development at Gerresheimer.

Right: The adapter of Gerresheimer's Gx syringes for screwing in the needle and the syringe cap is made from high-temperature Apec 1745 polycarbonate from Covestro



PHOTO: GERRESHEIMER

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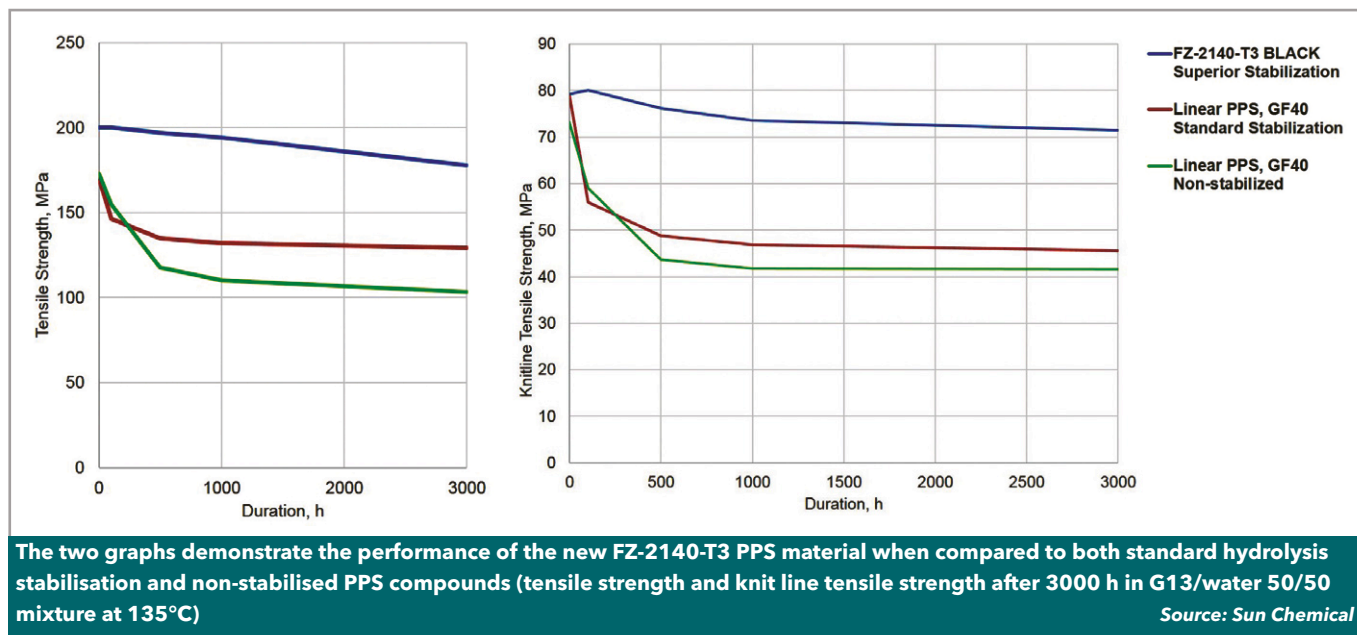


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strength, stiffness, and impact resistance similar to standard 40% glass fibre reinforced grades, but with a density 9% lower, he says.

EVs are the future, but it should not be forgotten that there is still plenty of life left in the internal combustion engine. In a recent blog, Russell Bloomfield, General Technical Service Engineer with **DSM**, discussed challenges for materials used in turbo-charged engines. He notes that some analysts predict the global automotive turbocharge market to reach \$24.2bn by 2023 with 7.97% compound annual growth rate.

"New materials are needed to meet both fuel efficiency and under the hood space targets – materials need to have a better chemical resistance, higher peak temperature performance, and long-term heat aging performance at elevated temperatures," he says.

Integrating the charge air cooler (CAC) into the air intake manifold (AIM) reduces the length of pipe previously needed to reach the air-to-air cooler in the front of the vehicle – this leads to an increase in engine responsiveness, Bloomfield notes. "This drives up the temperature in the AIM (currently up to 230°C) and the mechanical requirements for the materials used."

Bloomfield highlights DSM's Diablo technology, improving the long-term temperature resistance of materials such as Stanyl PA46 and also Akulon PA66.

"Compared to first generation Diablo offerings, Stanyl Diablo HDT2700 has an improved Heat Deflection Temperature, which is an indicator of peak temperature capability," he notes. "Stanyl Diablo HDT2700 also offers best-in-class weld strength and ensures part integrity under pressure pulsation loads. It maintains high stiffness, even

while exposed to continuous-use temperatures up to 230°C tested up to 3,000 hours."

For medical

Away from industrial applications, **Celanese** says its evolving portfolio of high-heat polymers and technologies is bringing innovative solutions to customers in healthcare. Its Vectra MT Liquid Crystal Polymer (LCP), for example, is said to be highly beneficial for electrosurgical instruments, thanks to the thermal insulation provided to interior electronics and power supply. "Vectra MT LCP as well as Fortron MT PPS and Celapex PEEK enable a more efficient sterilisation with lower costs and quicker re-utilisation time thanks to the compatibility with high-temperature autoclave sterilisation," says a representative.

Fortron is also claimed to be the material of choice for minimally invasive surgical tools such as forceps, thanks to its high temperature and dimensional stability over repeated cleaning and sterilisation cycles. "Fortron MT PPS has extraordinary dielectric and insulation properties which make it an ideal choice for electrosurgical implements as well," says the representative.

Fortron, Vectra and Celapex retain superior mechanical properties after numerous sterilisation cycles, including steam and dry heat sterilisation. PPS and LCP combine heat resistance with a high CTI: around 200°C for Vectra (Class IIIa), and around 150°C for Fortron and Celapex (Class IIIb). This is a particularly important feature in high frequency surgery.

Another example cited for Vectra MT is in the internal components in inhaled nicotine devices. "The excellent dimensional stability required by the application in thermal shock and high temperature/

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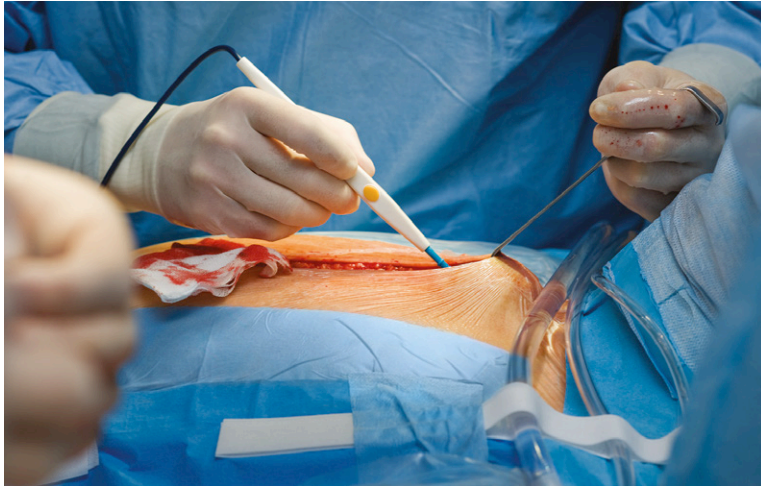
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high humidity conditions is achieved through Vectra's improved isotropic behaviour," says Celanese. Vectra MT LCP has superior flow and gas/moisture barrier properties, is an FDA grade and is compliant with USP Class 6/ISO-10993.

PEEK at the peak

PEEK is generally regarded to sit right at the top of the pyramid that groups thermoplastics in terms of overall performance. It may be difficult to believe that PEEK is over 40 years old, but in fact it was invented at ICI - now Victrex - in November 1978.

Victrex says it will present new polymers at K2019, together with advanced forms and parts in focus markets where the thermoplastics deliver a strong advantage.

The inert properties of PEEK and other PAEK polymers are a further reason for their success, says Victrex. "The polymers are ideally suited to extreme and demanding environments. Whilst alternative materials can meet specific needs, PEEKs can support multiple requirements."

This August, Victrex said it had achieved a new milestone for its automotive offerings. Its gear design and manufacturing facility in Grantsburg, USA, has received the IATF 16949 certification, "proving that the necessary systems and capabilities in line with Tier1/OEM needs are in place".

Victrex PEEK has been used in auto gears for decades, but since 2015 the company has been extending its material expertise to the design, development and manufacture of gears, to offer a fully integrated approach to thermoplastic PEEK gear solutions. It supports the development and testing of high-precision Victrex HPG-based gears, as well as manufacturing these gears as a component for integration into larger systems, for example within the engine, transmission, pump, actuator and chassis.

Andy Walton, Director Automotive at Victrex, says: "A major European car manufacturer has already

SABIC invests in PEI capacity

Polyetherimide (PEI) is another popular HTP, but the only polymer supplier, **SABIC**, has been hard put to meet demand in recent times. The good news is that it recently announced that it is making significant investments in expanding the capacity of its Ultem PEI (*Injection World* September 2018), as well as Extem thermoplastic polyimide. The new production plant, in Singapore, is due to come online in the first half of 2021. The company has also been debottlenecking plant in the US.

Ultem, which is an amorphous polymer (as is Extem), has long-term heat resistance up to 180°C; very high strength and stiffness up to 200°C; dimensional stability over a wide temperature range; strength retention and inherent flame resistance without additives. Extem can meet even higher heat requirements than Ultem, with enhanced creep and strength performance at elevated temperatures.

Rudy Miller, Director, High Heat Business, says SABIC is expanding Ultem production capacity by more than 50%. Debottlenecking at current production assets allowed it to start reducing lead times for make-to-order products by two weeks in 2018, and this year it has further reduced lead times by another five weeks. "Our ambition is to bring manufacturing lead times down to four weeks globally by or before the Singapore start-up," he says.

"There is a growing demand for high heat polymers, driven by stringent requirements in an increasing number of applications that are exposed to challenging or tough environments. Markets and product life cycles are moving faster than ever before. More than half of our High Heat Thermoplastics organisation is closely working with customers on new applications, and there are plenty in the pipeline."

SABIC does not say exactly how much capacity it has for Ultem, only that it sees CAGR in the range of 4-6%, approximately twice global GDP. "Supply has been tight, as with any other major specialty resin supplier," the company said in response to questions from *Injection World*. "We have all suffered from tightness in the industry and our capacity ahead of demand strategy will de-risk suffering from this in the future." SABIC estimates that over 80% of its Ultem resin is processed via injection moulding.

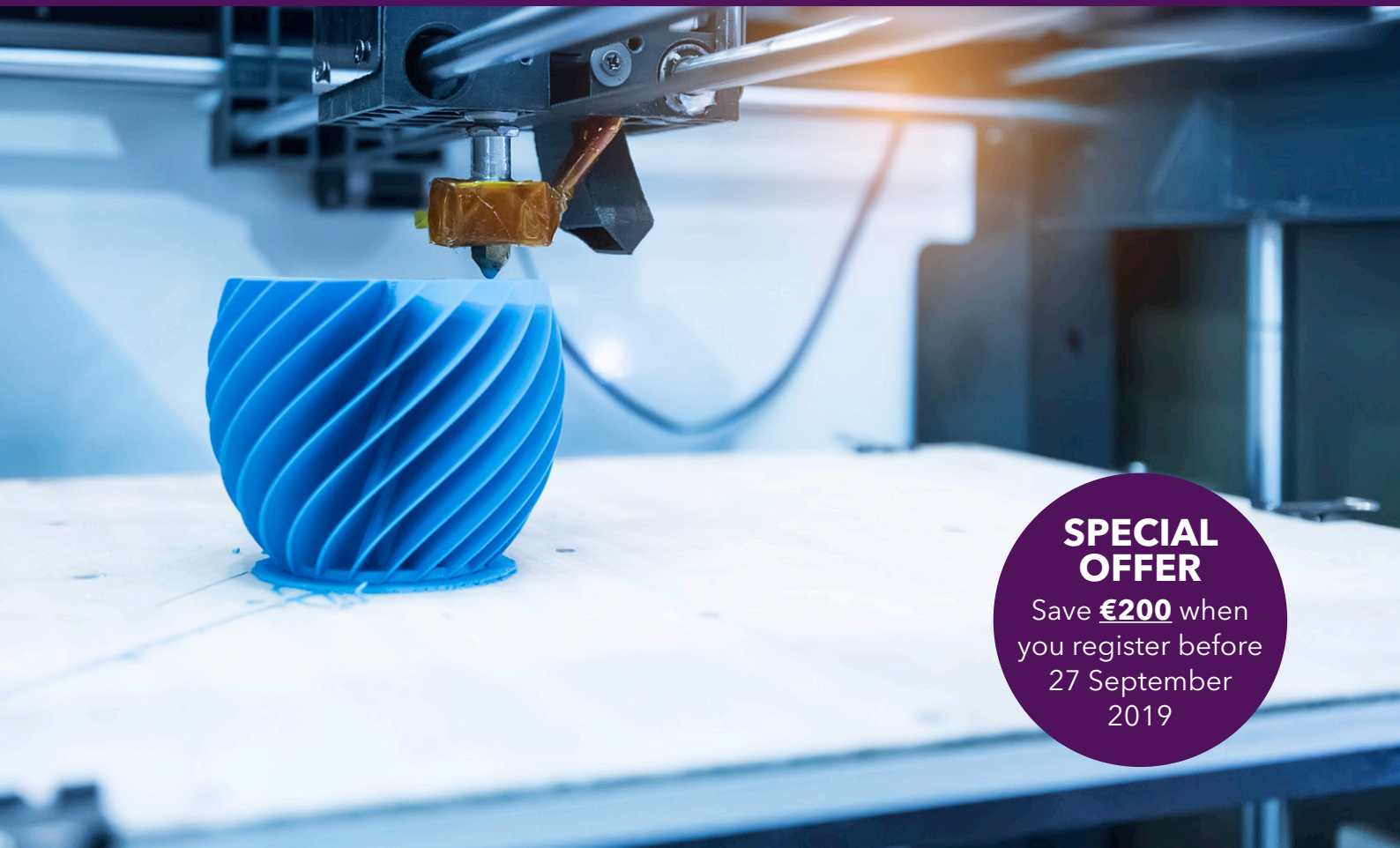
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taken advantage of our gear design approach, as our ability to look at the whole system, not just the gear, was invaluable. We are also working on numerous other programmes with global OEMs in other geographies, including the US."

At the beginning of this year, Victrex said it had invested in what it describes as "an innovative and differentiated tooling design and processing technology" called PtFS (Production to Functional Specification). Developed by UK-based Surface Generation, it uses patented hardware and proprietary software to, in Victrex's words, "actively manage multiple part areas during processing and drive reductions in the energy consumption, injection processing pressures and cycle times".

Victrex says the technology could enable customers access to produce more complex parts that may have limitations from traditional tooling designs used in injection or compression moulding due to heating and cooling profiles.

Jakob Sigurdsson, CEO at Victrex says: "We believe that the advantages of PtFS processing, where crucial controls can be applied to temperature levels in real time in the tool, could be a major advancement for our parts programmes, such as

medical or automotive gears and potentially in aerospace composite solutions."

Solvay Specialty Polymers, which has a host of HTPs in its portfolio, will present another new PEEK of its own at K 2019 (it already has several grades in its KetaSpire family). No details were available at the time of writing, other than Solvay describing the new product as "an industry first."

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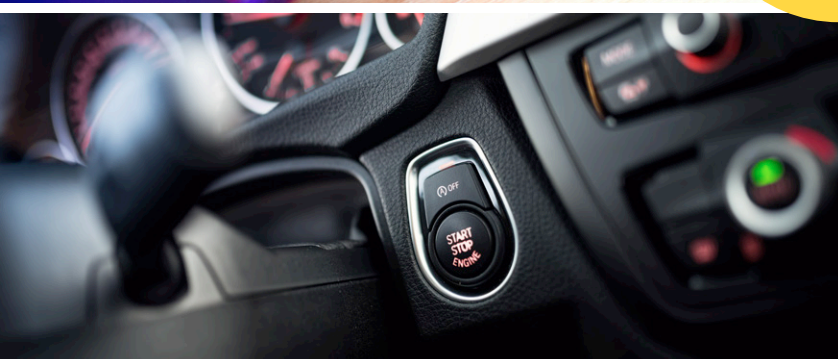
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Discussing design and materials in footwear



Ahead of AML's third edition of Polymers in Footwear, taking place in Berlin, Germany, in November, we preview the speakers from leading brands and industry innovators

AML is staging the Polymers in Footwear conference, discussing key industry trends, challenges and innovations for the footwear industry and its supply chain in November. The high-level international two-day conference will bring together polymer and additive suppliers, compounders, processing machinery experts, testing companies, shoe designers, and manufacturers to explore the wide range of existing and emerging materials and manufacturing technologies for producing footwear of all types.

The two-day conference takes place on 19-20 November 2019 at the Sofitel Hotel Kurfürstendamm in Berlin, Germany. It will be an essential networking and learning opportunity for polymer and footwear industry professionals, and provides an up-to-date view on market trends, new materials and technology developments.

Sustainable design and production methods, bio-based polymers and circular solutions for footwear applications, test methods, simulation technologies, 3D printing, three-dimensional bonding, automation, robotics and many more

topics will be covered in the programme.

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

Sustainability

The Polymers in Footwear conference opens with a presentation by **Nicoline van Enter**, Founder of **The Footwearists** in the Netherlands. This is followed by a panel discussion on key industry trends, challenges and innovations with a focus on sustainability. Van Enter is joined in the discussion by **Sabrina Zinner**, Manager Material Engineering Innovation Footwear, at **Puma** in Germany, and **François-Ghislain Morillion**, Co-founder, **VEJA** in France.

Next, **Arnaud Dabir**, Project Manager and **Reges Da Costa**, Lead Engineer, both at **VEJA** in France, are giving a joint presentation on a different approach to innovation: the "post-petroleum running shoe". **Anesca Swart**, Footwear Designer at **Footwear Hacking & Design** in Austria, looks at footwear design's accelerators, challenges and fiction. The last presentation in this session ex-



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Speakers at the conference include (from left to right) Nicoline van Enter from The Footwearists, Neil Wright from Steel Blue, Peter von den Kerkhoff from DuPont Tate & Lyle Bio Products, Mike George from Satra Technology and Arnaud Dabir from Veja

plores wood-based fibres as a sustainable and circular solution in footwear, given by **Birgit Schnetzlinger**, Business Manager Footwear, at **Lenzing** in Austria.

The conference's second session starts off with a presentation on zero-waste in ready-to-use reinforcement footwear components by **Alicia Malek-Luz**, Product & Process Development at **Rhenoflex** in Germany. Then there is a talk by **Neil Wright**, Head of Product Innovation, **Steel Blue** in Australia, on enhancing polymers for safety boot applications through graphene optimisation.

Next-gen materials

A paper on recent advances in use of copolyester-based thermoplastic elastomers (TPE) in footwear applications is being given by **Armand Duijsens**, Market Development Manager Arnitel, **DSM Engineering Plastics Research & Technology** in the Netherlands. Then, **Peter von den Kerkhoff**, Account Executive at **DuPont Tate & Lyle Bio Products** in Germany, is delivering an inside view on navigating the value chain, including case studies. The last presentation of Day One offers an opportunity for delegates to find out more about using polyamide 12 for new high-end sports applications that are demanding a unique balance of material properties, presented by **Klaus Hüls-mann**, Director Sports at Evonik Resource Efficiency in Germany.

Footwear science

Day Two of Polymers in Footwear is opened by **Mike George**, Footwear Technologist at **Satra Technology** in the UK, who will consider what makes a good shoe sole, discussing performance requirements and test methods. **Felix Willenbrink**, Marketing Manager Footwear/Sports/Leisure at **BASF Polyurethanes** in Germany, then speaks about simulation technology that drives footwear innovation, resulting in better design, less material and lower costs for shanks.

Technologies

The final session starts with a presentation by **Haymo Bertram**, Sales Director at **Fagus** in Germany, who will focus on HDPE shoelast types for automated shoe production. This is followed by a paper by **Tobias Grün**, Product Manager at **Voxeljet** in Germany, giving insight into high speed sintering that allows new flexibility in 3D polymer printing.

Adrián Hernández, Managing Director at **SimplicityWorks Europe** in Spain, is giving a joint presentation with **Johan Van Dyck**, Global OEM Business Development Manager Footwear at **Huntsman** in Belgium about rethinking the manufacturing process with three-dimensional bonding of materials. Closing the conference is **Sergio Dulio**, Innovation Manager at **AtomLab** in Italy, looking at the future of footwear manufacturing, including automation, robotics and digital transformation.

About Polymers in Footwear 2019

Polymers in Footwear 2019 provides a unique international meeting place for polymers and footwear industry professionals to explore the latest developments in this market, discuss the biggest challenges and solutions, as well as to share their learning with the goal to move the industry forward together, and into a more sustainable future.

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 Emma Hall: emma.hall@ami.international Tel: +44 (0) 117 314 8111.



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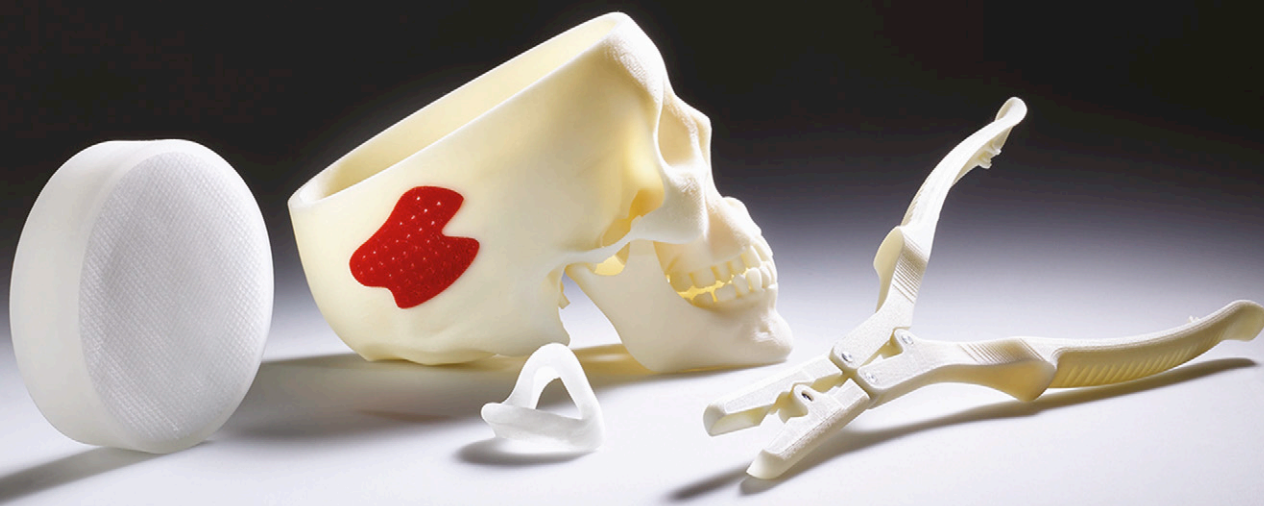
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Multiple applications for medical moulding



Leading manufacturers of injection moulding machinery report an increasing number of applications in the medical industry – from micro-fluidics to smart devices. By Mark Holmes

The scope for injection moulding in the medical industry is growing rapidly and machinery manufacturers are adapting their products to meet this need. The medical technology market continues to grow dynamically and offers opportunities for development in multiple directions, reports **Arburg**. Firstly, this is because new materials continually enter the market and expand the areas of application. In addition, there are constantly new technical advances in mould technology and in processes that can be applied to medical technology, for example in micromechanics and microfluidics. The operative terms in this context are liquid silicone rubber (LSR) processing, micro injection moulding or multi-component processing.

"The areas of healthcare and diagnostics are showing significant growth," says Martin Manka, Senior Sales Manager Medical at Arburg. "The general desire among people to monitor their health gives rise to an increased demand for pipette tips in diagnostics, for example. In addition, there are the areas of personal care and preventive healthcare. This includes smartwatches and other measuring devices that can be used to check and evaluate information such as pulse, calorie consumption,

movement and sleeping patterns at any time. Other popular products are insulin pens for diabetics and filters for dialysis. Another development step relates to smart devices with integrated electronics such as analysis chips that can communicate with smart-phones. Lab-on-a-chip technology, which has revolutionised diagnostics, is also a dynamic development trend. It is increasingly replacing conventional laboratory diagnostics and also making it possible to realise more individual therapies."

Traceability and process reliability are particularly important considerations in the field of medical technology. To meet the needs of this sector, Arburg says that it offers a wide range of injection moulding technologies, from standard solutions and high-speed, high-performance machines to Allrounders in stainless steel and tailor-made turnkey systems and cleanroom solutions. In particular, machines docked to the cleanroom provide significant energy efficiency advantages. Because of the reduced cleanroom volume, considerably less energy is required for cyclic air exchange.

In mass production, efficient processes are necessitated by the high cost pressures in this

Main image:
The Freeformer is Arburg's answer to the individual treatment of patients with precisely tailored medical products made of plastic. The spectrum ranges from auxiliary products to medication or implants

PHOTO: ARBURG



Above: The electric Allrounder 520 A has a clamping unit in stainless steel finish for GMP compliance. In a cycle time of around 4.5 s, the production cell produces 64 pipette tips

market. "The hybrid and electric Allrounders, which are also available in a packaging version, are designed for efficient and high-quality series production and are predestined for mass production applications in the personal care, medical and pharmaceutical industries, producing items such as pipette tips, syringe barrels and closures," says Sven Kitzlinger, medical expert from Arburg's application engineering consulting team. "They offer short cycle times, reproducibility and reduced energy requirements, as well as process stability and a long service life. They also boast better emission ratings than hydraulic machines. In addition to the increasing automation of production processes, the use of high-speed, high-performance machines for pharmaceutical packaging is another key area. There are increasing synergies with the packaging sector, where Arburg also has a high level of expertise."

He said: "Of course, the ongoing evolution in the materials sector, with increasingly specialised materials, is also opening up new areas of application. At the same time, products are becoming increasingly complex, which requires new mould solutions such as cube-mould technology. One example of this is assemblies that are injection-moulded in a single cycle using sophisticated mould technology, thus simplifying downstream assembly."

Right: Samaplast, a Swiss manufacturer of medical and technical products, uses a Freeformer 200-3X to produce small batches or single-unit batches

Arburg adds that the trend towards more individual therapies increasingly requires production of small-volume batches, down to one-piece flow. "For the implementation of such tasks, Arburg has the Freeformer in its portfolio, an industrial system for additive manufacturing," adds Lukas Pawelczyk, Head of Sales Freeformer. "Freeformers process qualified standard materials, enabling the use of a wide range of original materials as well as material and colour combinations. This includes medical grade thermoplastic elastomers or resorbable polylactide (medical PLA). The parts are of high quality and stability. Droplet size and process control can be specifically influenced, resulting in individual customisation options.

Potential applications include the individualisation of medication. A Freeformer could be used to produce individual medications that could be optimised in terms of dosage and type of release of the active substance, or even of combinations of active substances, to meet the requirements of patients and therapy."

He said: "It is possible, for example, to process medical PLLA (Purasorb PL18) to produce facial and cranial implants, or TPE (Medalist MD 12130H) to make individually adapted ventilation masks. Another interesting option is the possibility of combining injection moulding and additive manufacturing to customise mass-produced parts in single-unit batches."

In the field of injection moulding, LSR processing gains in importance. "The micro injection module for LSR processing combines a pressurised cartridge with prepared material, an LSR cylinder module and an 8mm screw," says Sven Kitzlinger. "The special LSR conveyor screw operates with a disc-type non-return valve based on the screw/piston principle. This permits minimal shot weights to be achieved with great precision and the required travel distances. The pressure at the transfer point between the cartridge and the injection screw is recorded. Homogeneously prepared, newly dosed silicone is therefore available for each shot, which means that the processing quality is accordingly high."

Digitalisation of the entire medical technology sector is another important dimension. The Arburg host computer system (ALS) offers availability, traceability and the monitoring of validated process windows for product and process reliability. As a central component of digital production, ALS can provide comprehensive digital answers to any questions arising in this context. Due to the requirements of unique device identification (UDI),



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Arburg adds that it is essential for manufacturers of medical devices to provide proof of complete batch traceability. ALS ensures this shot for shot. Not only process parameters are being monitored, but also machine statuses and maintenance intervals.

Arburg is also seeing a rising demand for turnkey projects in the field of medical technology. Integrating quality inspection and assembly equipment downstream of injection moulding is increasingly eliminating human intervention, which still represents the greatest potential for product contamination. The reliable production and reproducibility of extremely high-quality medical plastic products, including implants, also require intelligent process monitoring. Martin Manka says: "As a primary contractor, Arburg provides its customers with advice right from the outset, from concept design to the start of production. Whether it is implants, dental drills or syringe barrels, the company has found a suitable medical injection moulding solution for every application and material - for example by using the electric Allrounder A series which offers the best conditions."

Another example is a production cell built around an Allrounder 520 A which is producing LSR vaginal rings in high volumes. As primary contractor, Arburg was wholly responsible for the implementation of the entire turnkey system. This cleanroom application was developed in cooperation with Rico and 2KM as partners.

In micro-moulding, a micro injection unit specifically designed for processing LSR was presented for the first time in October 2018. The production cell produced elastic dosing valves for medical technology from non-post-cure LSR, weighing just 0.038g. The LSR with Shore A hardness 50 was premixed using a cartridge.



PHOTO: ARBURG

Injection was carried out using a special LSR screw with self-closing non-return valve. The parts made of non-post-cure LSR did not require post-treatment and were handled using a linear Multilift H 3+1. The finished dosing valves were checked for complete filling with two cameras, then transferred to a slit station and finally set down in containers, separated by cavities via a tube distribution system.

Arburg concludes that future developments will involve increased environmental awareness in the health industry. "One trend is the increasing use of single-type materials instead of mixed materials," says Martin Manka. "This also allows for an increased recycling rate. If you look at the amount of plastic waste generated in hospitals, for example, their current recycling rate is only around 10%. New solutions need to be found to reduce or recycle hospital waste. Leading pharmaceutical and medical technology manufacturers have set themselves the goal of making an important contribution in this respect. Wherever possible, biodegradable polymers are used that can be composted after use. A second approach is to avoid mixed materials, for example, different plastics that cannot be used as recyclates, or composites made of metal and plastic."

The ways medication is administered will also change significantly, adds Arburg, and there will be many exciting projects in this field, which will not only present machine manufacturers with new challenges, but also the entire value chain. "Eventually, biological medicines also need new solutions, and regulatory requirements are becoming increasingly important in the interests of increased patient safety," says Manka. "All of these are tasks that material manufacturers, mould manufacturers and machine manufacturers will face in the short to medium term and which require new solutions. Customers and all involved suppliers must pull together in order to find economical, but also environmentally friendly and safety solutions to the challenges in the medical sector - possibly with an impact on other industries as well." ➤

Above: For the production of medical parts, Arburg offers Allrounder injection moulding machines and the Freeformer for additive manufacturing

Left: Arburg's micro injection unit can be specified for medical moulding

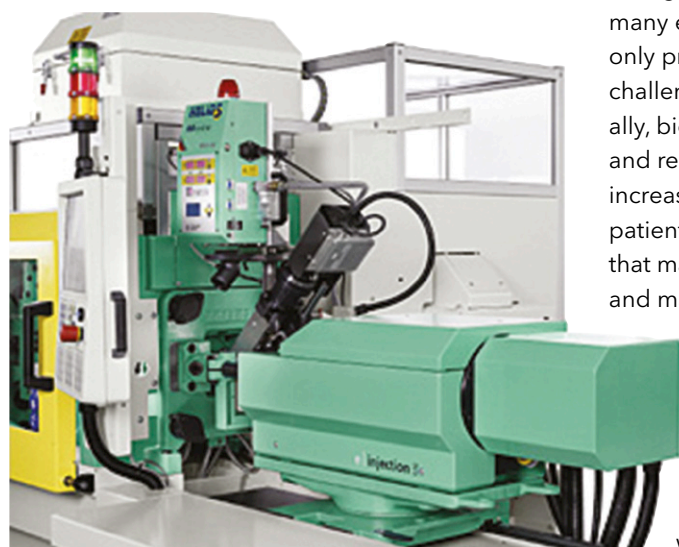


PHOTO: ARBURG

According to **Engel**, in medical moulding Industry 4.0 solutions are gaining in importance, through intelligent assistance systems in particular. The top guiding principle in the medical technology industry has always been to have everything under control at all times, and to be able to prove what quality levels were delivered when and to whom. New solutions that make production more plannable, safer and more stable are also attracting keen interest. The challenge lies in integrating them within the guidelines of GMP, EN-ISO and FDA. Engel adds that it has found a solution to integrate even dynamic process control into the validation process.

The iQ weight control assistance system is real-time control software that adjusts process parameters during the running cycle to ensure consistently high component quality. The software compares the injection pressure above the screw position with a reference pressure curve and identifies deviations in injection volume and viscosity. The automatic adjustment of the switchover point, injection profile and holding pressure compensates for target deviations shot by shot. Consequently, the switchover point and holding pressure level must be defined as critical process parameters in the validation strategy.

The validation strategy makes it possible to use intelligent assistance systems in medical technology, in order to further increase process consistency and process reliability. This allows quality fluctuations of the raw material and changes in ambient conditions to be dynamically and reliably compensated for in the validated process. Using

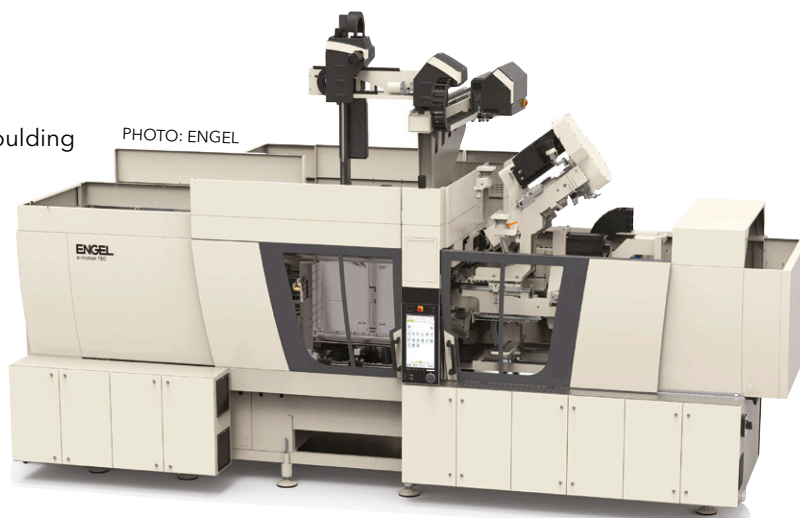
simple logic, the innovative algorithms employed by intelligent assistance systems can be integrated into the validation strategy.

Reducing cycle times and compact manufacturing

cells are also currently highly relevant in medical moulding, adds Engel. With the aim of further reducing cycle time, the process of producing housing parts for medical devices is split using two-component injection moulding. The process is cut down to a very short cycle time under realistic production conditions.

"The key thing with housing parts is the cooling time," says Georg Steinbichler, Senior Vice-President of research and development for technologies at Engel Austria. "Since the wall thickness

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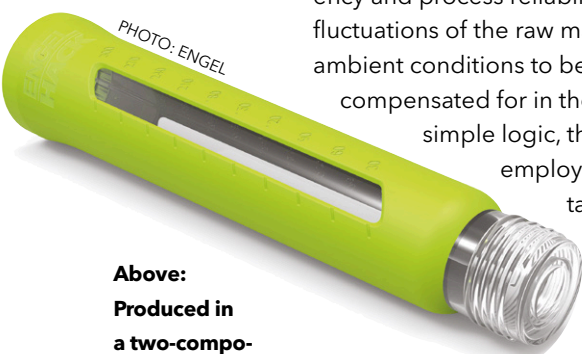


Above: A cleanroom version of an all-electric E-motion 310H/170W/160 combi injection moulding machine is used to produce housing parts

cannot be decreased for stability reasons, conventional one-component production leaves no opportunity to reduce the cycle time. But in the two-component process, we inject two thin layers, each of which quickly cools. Since both injection moulding steps are carried out at the same time, overall production efficiency increases."

At K2019 Engel will demonstrate a Hack Formenbau 8-cavity Vario Spinstack mould on the cleanroom version of an all-electric E-motion 310H/170W/160 combi injection moulding machine. This is equipped with a vertical indexing shaft with four positions: the first for injection moulding the bodies, using a transparent polypropylene from Borealis; the second for cooling; the third for applying a second layer of polypropylene (this time coloured green) to the pre-moulded parts; and the fourth for a viper 20 speed robot to step in and remove the parts. The linear robot reaches down to remove the eight housing parts from the closed mould, another factor contributing to the extra-short cycle time. Another advantage of the two-component process is that a sight glass can be added to the opaque housing just as it is being injection moulded.

The two-component precision mould is fully servoelectric in its operation and is the first to use a newly developed software programme. This ensures that the servoelectric movements – core-pull movements, for instance – can be controlled in the same way as those of hydraulic systems. "With the software's help, it makes no difference to machine operators whether the mould is hydraulically or servo-electrically operated," says Gerhard Dimmler, Senior Vice-President of product research and development at Engel Austria. "The user themselves can programme the servo-electric movements without the need for additional qualifications. As a result, we're paving the way for



Above: Produced in a two-component process, the housing parts for medical devices require a shorter cycle time

increased use of servo-electric moulds. They are more precise in many applications and allow for completely oil-free production when combined with all-electric injection moulding machines."

Mould maker **Schöttli, part of Husky**, is observing a number of key current market trends for plastics in medical applications. One trend is the digitalisation and miniaturisation of medical applications – components are becoming smaller and more intricate, and often feature a digitised piece, which adds a layer of complexity to the moulding process. The company is also seeing an increase in home medication, for example insulin pens, and smart functions to monitor usage of medical devices.

Quality assurance is driving a lot of technical developments, especially repeatable plastic part quality and invisible gate marks, says Schöttli. There is also a demand for lowering the total cost of ownership, with increased cavitation, smaller mould and press sizes, and faster cycles at increased quality expectations.

The company adds that the increase in home medication requires trouble-free operation and simple-to-use 'smart' devices in order to mitigate risk to the end user. As well as the standardisation of specific medical features, allowing the use of disposables with different brand devices.

In order to meet the needs of the medical moulding industry, Schöttli has developed a cluster side-gating system feeding eight plastic parts via individual side-gates, as well as servo-driven unscrewing and mould functions. Cooling functions have also been improved to reduce plastic part stress and increase productivity and the company is

focusing on further developing solutions that promote ease-of-use. The applications that these innovations target include the pipette market, blood collection tubes and feminine healthcare. Future developments at Schöttli include shortening validation time further before production begins by improving injection moulding process simulations and quality-driven services.

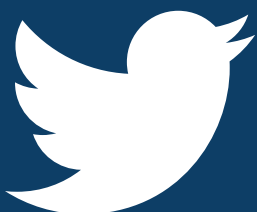
Medical moulders globally are seeking injection moulding machinery that offers the highest repeatability, precision, cleanliness, traceability and energy efficiency, and support customers with their product validation, says Nigel Flowers, Managing Director, **Sumitomo (SHI) Demag UK**. "Advanced batch tracking, contact-free inspection using cameras, and highly automated assembly are among the latest developments. From an injection moulding machinery perspective, systems need to be cleaner, cooler, faster and quieter, with more



PHOTO: SUMITOMO (SHI) DEMAG

Above: Cleanroom ready and energy efficient, the IntElect S being launched by Sumitomo (SHI) Demag at K2019 delivers process stability to medical moulders

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Automated overmoulding of syringe needles

US injection moulder **Moldworx** has developed a process for the production of hypodermic needles using the overmoulding process to reduce costs and improve productivity. The company says that it can design and build moulds to inject medical grade plastic around stainless steel needles as small as 0.012 in (0.305 mm), as well as the automation for this project. Moldworx was asked by a medical OEM to develop a single cavity injection mould to overmould a needle that is currently being glued in place. The first stage involved designing and developing an A-Series, single cavity injection mould with slides, with the needle being hand-loaded into the mould by an operator then moulded to a finished assembly to test the design.

The next stage was designing a production mould and automation that would robotically feed the needles into the mould cavity, thus eliminating the operator. One challenge that Moldworx had to overcome was singulating

thousands of tiny needles that are bulk-packed. To do this, it designed and developed a 'singulator' with a 'hopper' that would introduce one needle at a time in the cell. Each needle is picked up by a robot and indexed in front of a set of high resolution inspection cameras. The needle is then placed into the mould, and the mould closes for the injection cycle. The robot removes the moulded assembly and the process repeated with all actions undergoing inspection and verification.

After successfully completing the single-cavity mould and automation, with customer testing and approving the parts, Moldworx built a multi-cavity mould with the required integrated automation cells. The 4-cavity production mould will quadruple the automation cell production to keep up with required demand.

Moldworx developed the automated process to reduce costs and improve productivity



precise injection control, together with smoother mould and ejector movements. The lifecycle of equipment and total cost of ownership are also big considerations."

At K2019, Sumitomo (SHI) Demag will unveil its latest IntElect S medical machine, which has been specifically built to handle extremely narrow tolerance medical applications produced in high volumes, without having to invest in a larger machine to accommodate larger multi-cavity tool sizes. The 180-tonne IntElect S has an extended tie bar distance in order to fit larger multi-cavity moulds and matched to the smaller injection unit. Flowers says this is especially beneficial for precision medical moulders. The 180-tonne IntElect S is GMP-compliant, with the layout of the mould space featuring special stainless steel covers to ensure it is clear of contaminants, particles and lubricants.

In order to enhance patient safety, there is a drive towards using new and more innovative regulated materials with a better flow and high impact strength to mould components. "This is in order to meet future EU regulations, including the EU Medical Device regulations that come into effect 26 May 2020, as well as the In Vitro Diagnostic

medical device regulations (known as IVDR) that are effective 26 May 2022," adds Flowers. "The demonstration at K2019 will showcase the moulding of pipette tips on a 64 cavity mould tool in partnership with Borealis. Bomed BJ868MO is a PP copolymer that was developed for the express purpose of enabling healthcare customers to achieve full compliance with MDR and IVDR when an antistatic agent is not required. The stiffness of the material delivers improved cycle time optimisation."

Flowers notes the suitability of the IntElect machines for medical micro-moulding thanks to the ability to install small screws, matched with a large mould space which improves the dosing and injection performance. This is made possible by the IntElect's highly dynamic direct drive technology, which enables the acceleration of the injection speed to fill 64 cavities with precision.

Another driver in medical injection moulding is item-level traceability, with new directives just around the corner, according to Flowers. "As a high liability market, authentication of individual components requires a fingerprint style approach to traceability," he says. "Real-time traceability is about being able to call up data and verify the



PHOTO: KRAUSSMAFFEI

exact settings used on the injection moulding machine when that individual plastic part was made. That's where connectivity to a Management Executive System (MES) is vital. For parts being produced on multi-cavity tools, like pipettes, robots are programmed to remove and place the components into cavity-assigned racks. This means that if an issue with cavity 1 arises, the rack containing all corresponding cavity 1 parts can be isolated and the rack recalled, with all the production information stored in the MES. The new IntElect S 180-tonne also introduces new user parameters to ensure that processes are kept within specified ranges and operators cannot make adjustments unless they have been granted authorisation."

The company says that as well as fast cycling time, the IntElect S 180-tonne machine offers moulding sustainability, energy efficiency, machine longevity and total cost of ownership. Sumitomo (SHI) Demag adds that it has conducted extensive machine and part lifecycle durability tests for the IntElect S, comparing it to equivalent all-electric injection moulding machines on the market. These tests have confirmed that the enhancements made to the high performance drives increase the machines' lifespan and consequently decreases total cost of ownership.

Flowers adds that another example of how the company is optimising investments for medical moulders is with the launch of eMultiPlug. Designed for plastic moulders who want the option of transforming an existing moulding system into a multi-component press, the eMultiPlug uses the same drive as the IntElect machine. As an independent unit, eMultiPlug can be retrofitted to an existing machine, making multi-component injection more cost efficient and feasible.

KraussMaffei and **Netstal** are combining their expertise in injection moulding machinery under the new KraussMaffei umbrella brand. With the common portfolio, the company says that it wants to present itself even more effectively, particularly in the medical technology and packaging indus-

tries. In medical technology, the company adds that the focal points of the fast-running Netstal Elion 800 machine are output quantity and high precision. Sixteen syringes of cyclic olefin copolymer can be shaped under cleanroom conditions. Smart operation for the aXos control system ensures free-of-defects compliance with GMP. The digital in-line printing of the syringe body is a new development.

In addition, the smallest all-electric PX 25 with a clamping force of 250 kN demonstrates highly challenging medical micro-moulding with LSR. A micro membrane with a shot weight of only 0.3g (8 cavities) takes shape within 14 s cycle time. For this purpose, a screw for extremely low shot weights, measuring only 12 mm in diameter, was developed. The APC Plus machine function is also suitable for micro-moulding automation tasks with LSR and ensures high shot weight consistencies and, consequently, uniform component quality. Machines are equipped with cleanroom features, which include easy-to-clean surfaces. The product range also includes digital services for process improvement and for collecting and evaluating data.

CLICK ON THE LINKS FOR MORE INFORMATION:

- > www.arburg.com
- > www.engelglobal.com
- > www.husky.co
- > www.sumitomo-shi-demag.com
- > www.kraussmaffei.com
- > www.moldworx.com

Left: The all-electric PX 25 from KraussMaffei



PHOTO: SUMITOMO (SHI) DEMAG

Above: By adjusting the tie bar distance, the IntElect S 180 tonne can accommodate a larger mould tool enabling medical moulders to produce parts in high volumes

Download these new product brochures

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

SOLVAY: TECHNYL 4EARTH



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

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POLYKEMI: CUSTOM COMPOUNDS



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

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HEXPOL: DRYFLEX TPES



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

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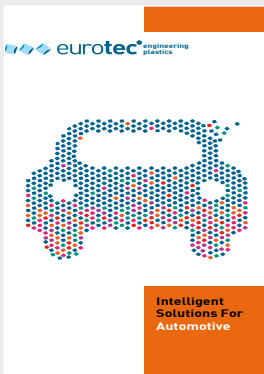
BOY: PROCAN ALPHA 4



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

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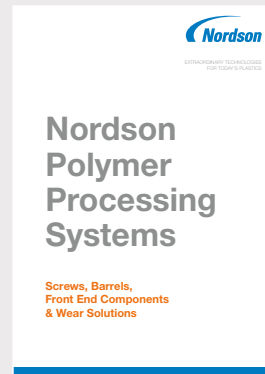
EUROTEC: AUTOMOTIVE COMPOUNDS



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

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NORDSON PROCESSING SYSTEMS



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

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

Optimise your industry knowledge with AMI's recommended databases

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

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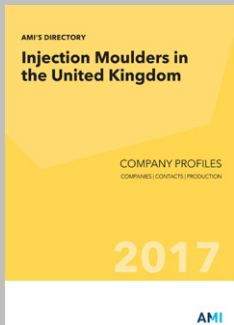
Injection Moulders in France



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

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Injection Moulders in the United Kingdom



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

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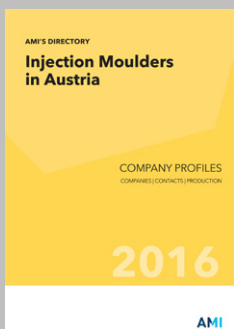
Injection Moulders in Spain and Portugal



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

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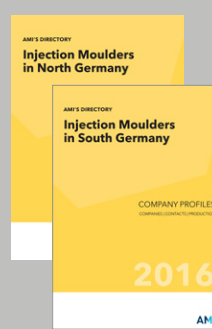
Injection Moulders in Austria



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

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Injection Moulders in Germany



Germany is the leading country for injection moulding in Europe. The company profiles of 2350 injection moulding sites in Germany reveal in-depth contact and production information. The data is available in book format in 2 volumes for the North and South of Germany, or as a single database which gives you extensive search capabilities.

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Learn more about AMI's upcoming conferences

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

SMART PACKAGING



The 4th edition of AMI's successful Smart Packaging conference takes place on 10-11 September 2019 in Hamburg, Germany. Learn about the latest technologies across the industry, encompassing food, FMCG and pharmaceutical packaging.

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MASTERBATCH



Get your annual update on the global masterbatch industry at AMI's highly regarded Masterbatch conference on 10-12 September 2019 in Vienna, Austria. The event is aimed at masterbatch processors, manufacturers, researchers, materials and equipment suppliers and brand owners.

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POLYMER TESTING & ANALYSIS



The 4th edition of the Polymer Testing & Analysis conference, taking place on 18-19 September 2019 in Düsseldorf, Germany, will gather together materials scientists, laboratory staff, researchers and R&D professionals who develop, test and analyse new polymer materials.

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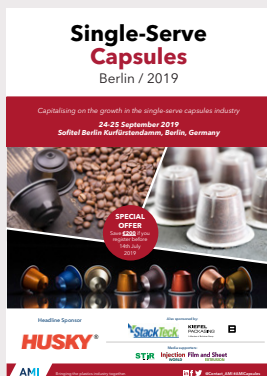
POLYMERS FOR 3D PRINTING



A new event for North America, AMI's Polymers for 3D Printing conference is taking place on 24-25 September in Cleveland, OH. Expert speakers will cover the latest developments in plastics, filaments, powders and technology in the rapidly growing additive manufacturing market.

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SINGLE-SERVE CAPSULES



The 3rd edition of AMI's international Single-Serve Capsules conference will take place on 24-25 September 2019 in Berlin, Germany. The urgent need to review the materials used for capsules in search of sustainable options will be a key topic of discussion.

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THIN WALL PACKAGING



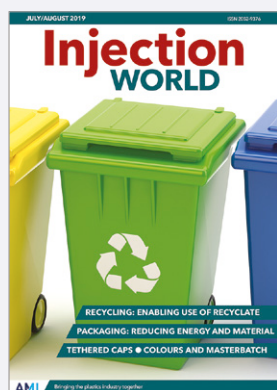
Get your annual update on the global thin wall packaging industry at AMI's Thin Wall Packaging conference on 2-4 December 2019 in Düsseldorf, Germany. The event gathers leading brand owners, retailers, packaging manufacturers, researchers and suppliers to the packaging industry.

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

Keep informed: read our latest editions

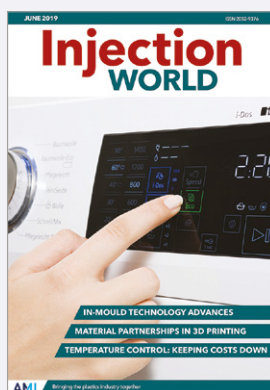
AMI publishes five process-specific FREE plastics industry magazines. Simply click on the cover below to read each magazine. Or download the issue in the relevant Apple or Android app



Injection World July/August 2019

The July-August issue of Injection World looks at technology enabling injection moulders to use more recyclate. Plus features on packaging and masterbatch and analysis of tethered caps regulation.

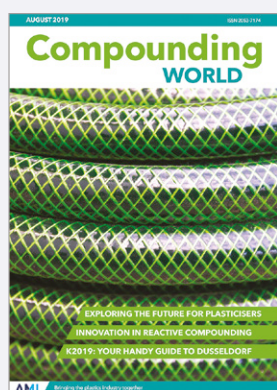
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Injection World June 2019

The June edition of Injection World magazine looks at the latest innovations in decorative and functional IML technologies. It also explores developments in additive manufacturing and temperature control.

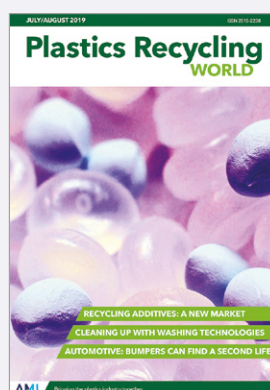
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Compounding World August 2019

The August edition of Compounding World looks at the latest technical and regulatory developments in PVC plasticisers. Other technologies in this month's spotlight include reactive compounding, wear resistant machine parts and WPCs.

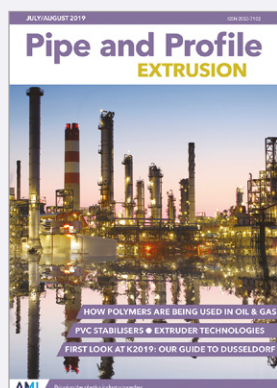
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Plastics Recycling World July/August 2019

The July/August edition of Plastics Recycling World takes a detailed look at the growing range of additives available to plastics recyclers. It also explores new developments in washing equipment and reviews a major US car bumper recycling project.

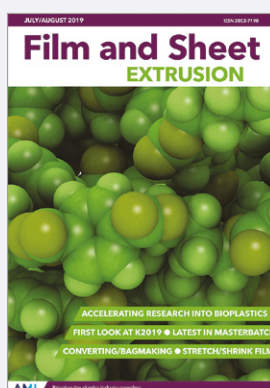
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Pipe and Profile July/August 2019

The July-August edition of Pipe and Profile Extrusion looks at how polymer pipes are being used in the offshore oil and gas sector. Other features cover extruder innovations to be shown at K2019 and developments in PVC additives.

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Film and Sheet July/August 2019

The July-August edition of Film and Sheet Extrusion looks at the accelerating research into bioplastics applications, plus stretch and shrink film, masterbatches, bag-making machinery and a Visitor Guide to K2019.

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Compounding
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GLOBAL EXHIBITION GUIDE

2019	18-21 September	T-Plas/Tiprex, Bangkok, Thailand	www.tplas.com
	16-23 October	K2019, Dusseldorf, Germany	www.k-online.com
	17-19 October	Plastics, Printing & Packaging, Dar-es-Salaam, Tanzania	www.expogr.com/tanzania/pppexpo
	25-28 November	Plastivision Arabia, Sharjah	www.plastivision.ae
	27-29 November	Plastics & Rubber Vietnam	www.plasticsvietnam.com
2020	13-16 January	Saudi Plastics & Petrochem, Riyadh	www.saudipp.com
	16-20 January	Plastivision India, Mumbai, India	www.plastivision.org
	21-23 January	Swiss Plastics, Lucerne, Switzerland	www.swissplastics-expo.ch
	28-31 January	Interplastica, Moscow, Russia	www.interplastica.de
	9-11 March	Plast Alger, Algiers, Algeria	www.plastalger.com
	11-13 March	Expo Plasticos, Guadalajara, Mexico	www.expoplasticos.com.mx
	7-13 May	Interpack, Dusseldorf, Germany	www.interpack.com
	3-4 June	Compounding World Expo, Essen, Germany	www.compoundingworldexpo.com/eu
	8-11 June	Argenplas, Buenos Aires, Argentina	www.argenplas.com.ar
	21-25 September	Colombiaplast, Bogota, Colombia	www.colombiaplast.org
	13-17 October	Fakuma, Friedrichshafen, Germany	www.fakuma-messe.de
	4-5 November	Compounding World Expo, Cleveland, US	www.compoundingworldexpo.com/na

AMI CONFERENCES

10-11 September 2019	Smart Packaging, Hamburg, Germany
18-19 September 2019	Polymer Testing & Analysis, Dusseldorf, Germany
24-25 September 2019	Polymers for 3D Printing, Cleveland, OH, US
24-25 September 2019	Single-Serve Capsules, Berlin, Germany
19-20 November 2019	Polymers in Footwear, Berlin, Germany
26-27 November 2019	Polymer Foam, Hamburg, Germany
2-4 December 2019	Thin Wall Packaging, Dusseldorf, Germany

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



3 - 4 June, 2020
ESSEN, GERMANY



4 - 5 November, 2020
CLEVELAND, OHIO

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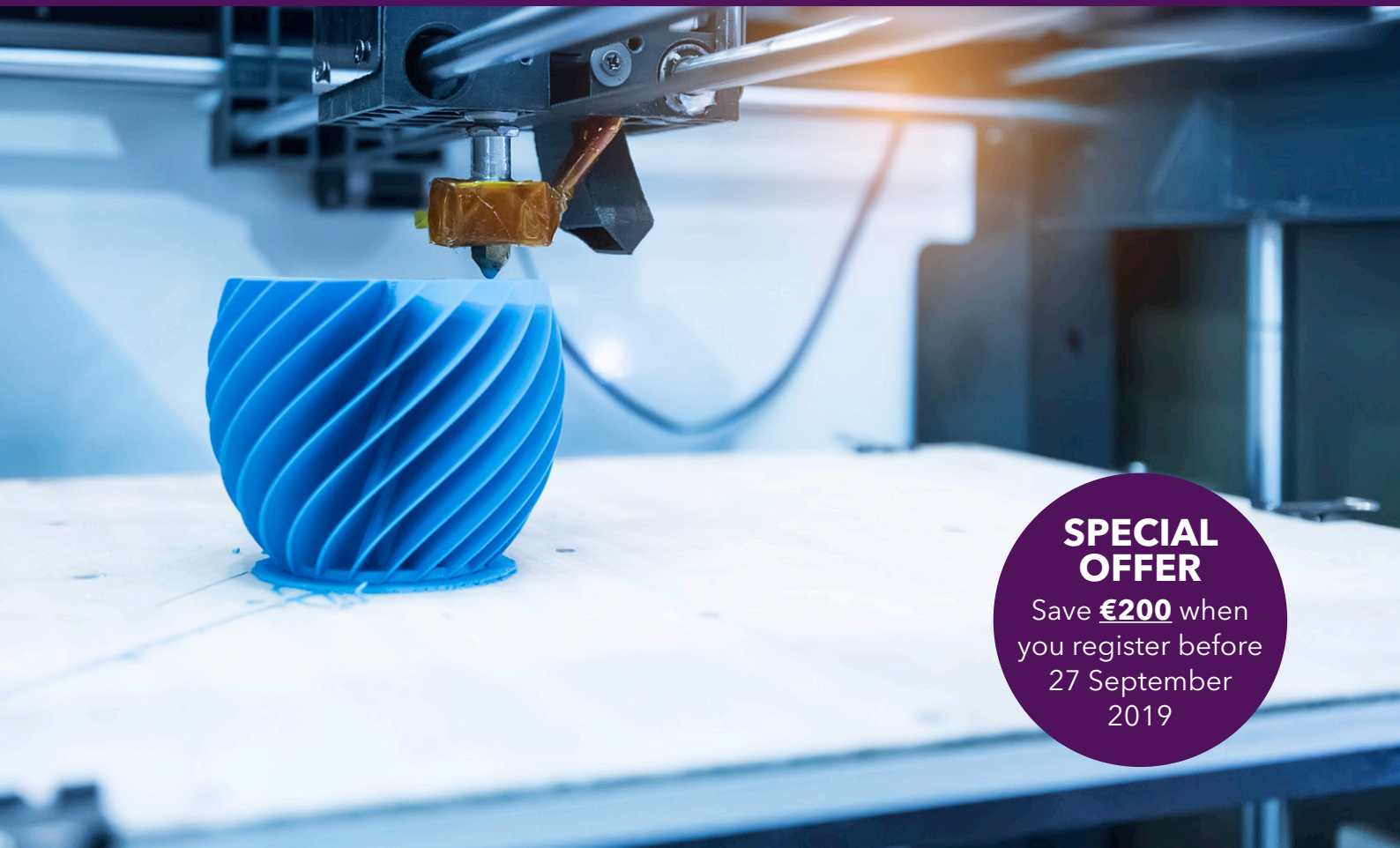
Polymers for 3D Printing

Düsseldorf / 2019

*Developing polymers and filaments for
optimised 3D printing applications*

11 - 12 December 2019

Meliá Düsseldorf, Düsseldorf, Germany



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Polymers for 3D Printing

Düsseldorf / 2019

Polymers for 3D Printing is a two-day conference from AMI exploring the development, production and application of innovative polymers and compounds for 3D printing and other rapid manufacturing technologies. The event will be held at the Meliá Hotel in Düsseldorf, Germany on 11-12 December 2019.

3D printing is growing globally with increasingly customised materials being used to fulfil the expanding scope of applications. The technology is being utilised in the design, prototyping and production of industrial and consumer goods, with diverse applications ranging from household appliances, healthcare and mechanical parts to building & construction and transportation.

Expert speakers will cover the latest developments in plastics resins and compounds for a variety of 3D printing and rapid manufacturing methods to accelerate product development and production.

The event will examine incumbent materials, including ABS, PLA and PETG, together with new high-performance polymers and compounds with added functionality. These are helping to improve productivity, boost performance, add value, meet sustainability requirements and open up new markets.

The event will provide excellent networking opportunities during the refreshment breaks and evening drinks reception, which will take place in a dedicated exhibition area.

”

*AMI is up to date for
my target market and
interest*

Technical Director, JSP



Five good reasons to attend:

- **Identify new and emerging market opportunities for polymers and compounds for 3D printing**
- **Hear experts address new processing and real-world application opportunities**
- **Discover new ways to optimise production and to add value in this rapidly evolving market**
- **Listen to your customers' views on their future needs**
- **Build focused, professional networks with key industry stakeholders**

Ways to get involved:

ATTEND

Register before 27 September 2019 and pay €1040* saving €200 on the full price of €1240*. There are additional discounts for group bookings. The registration fee includes attendance at all conference sessions, the Networking Cocktail Reception, lunch and refreshment breaks on both days and a set of conference proceedings.

SPONSOR

A variety of sponsorship opportunities are available at this conference to help promote your company's products and services to this highly targeted international audience. Contact the Conference Hotline for further information.

EXHIBIT

Make it easy to engage with the audience at this busy event with your own highly visible exhibition space. Bring your own display stand and / or banners and use the space to showcase your company's products and services and make a lasting impact. The exhibition runs throughout the conference by the main meeting room and is host to the networking functions.

Space is limited so to avoid disappointment please register for this service as soon as possible.

*VAT may apply

CONFERENCE HOTLINE

Contact: Harriet White, Conference Organiser
Tel: +44 (0) 117 314 8111
Email: harriet.white@ami.international

SAVE €200

Register before
27th September
2019

Wednesday 11 December 2019

- 08:30 Registration and welcome coffee
09:30 Opening announcements

SESSION 1 - MARKET OVERVIEW

- 09:40 **Design for additive manufacture**
Dr. Connor Myant, Assistant Professor in Design Engineering,
DYSON SCHOOL OF DESIGN ENGINEERING,
IMPERIAL COLLEGE LONDON, United Kingdom

SESSION 2 - 3D PRINTING POLYMER DEVELOPMENTS

- 10:10 **How tailored ABS based resins add value to FDM 3D printing**
Mr. Luca Chiochia, Business Development Manager,
ELIX POLYMERS, Spain
- 10:40 **Rapid prototyping made easy through 3D printed LDS materials**
Dr. Mark Berix, Product Development Specialist,
MITSUBISHI ENGINEERING PLASTICS EUROPE, Netherlands
- 11:10 Coffee Break
- 11:50 **High performance powders for functional applications in powder bed fusion**
Mr. Stefan Josupeit, Product Manager Powder Bed Fusion,
BASF 3D PRINTING SOLUTIONS GmbH, Germany
- 12:20 **Innovative flexible 3D printing TPU solutions from prototyping to mass production**
Mr. David Pascual, Global 3DP Marketing Manager,
LUBRIZOL ADVANCED MATERIALS INC., Spain
- 12:50 **Development of novel daylight-curable photopolymer resins for functional applications**
Dr. Sarah Karmel, Head of R&D, Chemistry,
PHOTOCENTRIC LTD, United Kingdom
- 13:20 Lunch
- 14:50 **Latest trends in 3D printing of PEEK and polyimides**
Mr. John Biesterfeld, CEO,
BIEGLO GmbH, Germany
- 15:20 **High throughput screening for 3D printable antimicrobial polymer**
Ms. Ling Xin Yong, Postgraduate Researcher,
UNIVERSITY OF NOTTINGHAM, United Kingdom

SESSION 3 - DEVELOPMENTS IN CONTINUOUS FIBRES

- 15:50 **New technology: 3D printed continuous fibres, enabling composite parts robust enough to replace machined metal**
Mr. Joachim Kasemann, Owner and VP Sales,
MARK3D GmbH, Germany
- 16:20 Coffee Break
- 17:00 **Continuous fibre additive manufacturing, 3D printing large composite parts for the industry sectors**
Mr. Lucas Janssen, Operations Director,
CEAD, The Netherlands
- 17:30 **New developments in embedding unique functionalities in composites by continuous fibre printing**
Mr. Andrea Gasperini, Scientist Additive Manufacturing,
BRIGHTLANDS MATERIALS CENTER, Netherlands
- 18:00 Networking Cocktail Reception

Thursday 12 December 2019

- 08:00 Welcome coffee
09:00 Opening announcements

SESSION 4 - APPLICATIONS

- 09:10 **We print to drive: 3D printing at Deutsche Bahn**
Dr. Tina Schlingmann, AM Technology Scout and Material Expert,
DEUTSCHE BAHN AG, Germany
- 09:40 **AM materials development geared by applications**
Dr. Harold van Melick, R&D Director,
DSM ADDITIVE MANUFACTURING, Netherlands
- 10:10 **Latest 3D printing applications driven by high performance polymers**
Ms. Gülay Bozoklu, Senior Project Application Engineer EMEA,
STRATASYS GmbH, Germany
- 10:40 Coffee Break

SESSION 5 - PROCESS DEVELOPMENTS

- 11:20 **How desktop SLS can be used in hospitals**
Mr. Konrad Glowacki, Co-Founder and Chief Business Development Officer,
SINTERIT, Poland
- 11:50 **Expandable FFF materials, a new dimension in 3D Printing**
Mr. Ruud Rouleaux, Company Owner and CEO,
COLORFABB BV, The Netherlands
- 12:10 **Series production with laser sintering requiring process development, new materials and automation**
Mr. Stefan de Groot, Technology Manager and Project Leader Additive Manufacturing,
PROTIQ GmbH, Germany
- 12:50 Lunch
- 14:20 **SLA 3D printing for engineering: innovative materials and applications**
Ms. Klaudia Kantarowska, Additive Manufacturing Engineer,
FORMLABS Germany
- 14:50 **3D printing of CNT-based electrically conductive nanocomposites by fused deposition molding**
Dr. Nadir Kchit, Industrial and Composites Project Leader, Technical Service & Development,
NANOCYL, Belgium
- 15:20 **The trash printer: developments in accessible and sustainable larger scale additive manufacturing**
Mr. Jeric Bautista, Additive Manufacturing and Product Engineer,
RE:3D, INC., United States
- 15:50 Conference ends

AMI reserves the right to alter the programme without notice. The latest programme, including any new speakers, changes to the schedule, and any amendments to pricing and terms and conditions can be viewed on our website: www.ami.international

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Please confirm that you agree to your name being published alongside your company name and job title on the delegate list.

☐ Yes ☐ No

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PARTICIPATION

	Price	VAT	Total
<input type="checkbox"/> Early Booking Delegate Admission Fee ¹ : (until 27 September 2019)	€1,040.00	19%	€1,237.60
<input type="checkbox"/> Delegate Admission Fee ¹ : (from 28 September 2019)	€1,240.00	19%	€1,475.60
<input type="checkbox"/> Exhibition Space: (UK Companies) ³	€1,825.00	20%	€2,190.00
<input type="checkbox"/> Exhibition Space: (Non-UK Companies) ⁴	€1,825.00	0%	€1,825.00
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Account number: 06814077 Bank no. 556138
IBAN: GB63 NWBK 6072 0306 8140 77 SWIFT: NWBKGB2L

POLYMERS FOR 3D PRINTING 2019 CONFERENCE INFORMATION

11-12 December 2019
Meliá Düsseldorf
Inselstraße 2
40479 Düsseldorf
Germany
Tel: +49 30 2238 5762

HOTEL ACCOMMODATION

Delegates are responsible for booking their own accommodation. AMI has negotiated a limited number of rooms at the rate of €169.00 for single use and €194.00 for double use (breakfast and Wi-Fi included) at the Meliá Düsseldorf until 11th October 2019.

To book, contact the Reservations Department directly, please call +49 30 2238 5762 and quote 'AMI's Polymers for 3D Printing'.

PARTICIPATION OPPORTUNITIES

Delegate registration: includes attendance at all conference sessions, a set of conference proceedings, entrance into the Networking Cocktail Reception, lunch and coffee breaks.

Sponsor this event: maximise your company profile before, during and after the event by becoming a sponsor. For further information, please contact the Conference Organiser

Exhibition space: an excellent way to enhance your business opportunities and make it easy for delegates to find you! Includes:

- entry for one representative from your company
- one exhibition space in the networking area
- your company profile in the conference proceedings
- new and existing product display
- handing out brochures and promotional items from your stand

Spaces are allocated on a first-come-first-served basis and sell quickly.

Group discounts: when registering as a group you may be entitled to discounts. Contact the Conference Organiser for more information.

Networking Cocktail Reception

A networking cocktail reception will be held on the first evening. This offers an excellent opportunity for delegates to meet with speakers and other colleagues. All delegates are invited to attend and admission is included in the delegate fee.

CANCELLATIONS

Full refunds, less a cancellation charge of €300 will only be made on cancellations received prior to 11th October 2019. Thereafter we regret that no refunds can be made. Delegates may be substituted at any time. Please note that refunds will not be given on exhibition upgrades or sponsorship packages.

CONFERENCE HOTLINE

HARRIET WHITE, CONFERENCE ORGANISER

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AMI reserves the right to alter the programme without notice. The latest programme, including any new speakers, changes to the schedule, and any amendments to pricing and terms and conditions can be viewed on our website: www.ami.international