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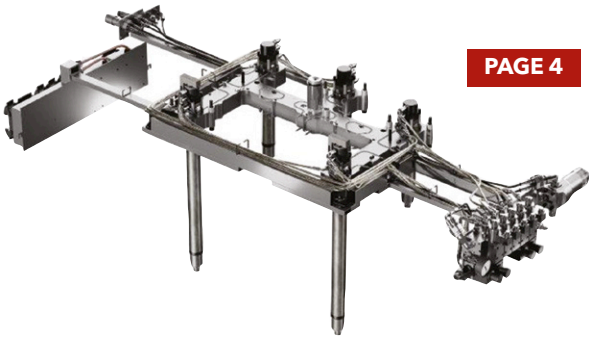

PAGE 4

PAGE 13

PAGE 25

PAGE 37

COMING NEXT ISSUE

› 3D Printing › Bioplastics › Energy Management

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Injection molding expo will debut in Detroit in March 2022

AMI and the Crain Global Polymer Group are launching a major American exhibition focused on the design and production of injection-molded plastic parts and products. The first **Injection Molding and Design Expo** will take place on March 16-17, 2022 at the TCF Center (formerly the Cobo Center) in Detroit, Michigan, USA. It is backed by Crain's *Plastics News* and AMI's *Injection World* magazines.

The exhibition and its three focused conference theaters will be free to attend to ensure they attract a large audience of relevant specifiers and buyers from throughout the supply chain. Exhibitors that have already booked booths at the event include Wittmann Battenfeld, KraussMaffei, Tederic, Fast Heat, Mastip, Beaumont Technologies, Polykemi and Zeiger Industries.

INJECTION MOLDING & DESIGN EXPO
FROM CONCEPT TO DELIVERY

Focused expo

"We believe that America's large and diverse injection molding market will really benefit from a focused expo that provides a cost-effective and time-efficient way to exchange information and build new business", said Brennan Lafferty, VP and group publisher for the Crain Global Polymer Group. "The Injection Molding and Design Expo will fulfill an important need in this market, similar to what the Fakuma show achieves so well in Europe."

Andy Beevers, AMI's events and magazines director, added: "We are delighted to be partnering with Crain to launch this exciting new exhibition, which is a logical extension of AMI's successful expos focused on compounding, extrusion and recycling that take place in Cleveland, Ohio. The initial reaction to the new event has been extremely positive, and working with Crain and *Plastics News* will enable us to deliver an exhibition that exceeds the expectations of exhibitors and visitors alike".

Headquartered in Detroit, Crain Communications is one of the largest privately held business media publishers in the world. Its Global Polymer Group publishes *Plastics News*, which is the plastics industry's only weekly magazine and has 45,457 print subscribers. In addition, Crain publishes *Automotive News* and local business titles in Detroit, Cleveland, Chicago and New York.

AMI is a leading provider of market intelligence and events to the plastics industry. It organizes a group of expos focused on plastics compounding, recycling and extrusion that take place in Cleveland, Ohio. These attracted 261 exhibitors and 4,375 visitors from 42 countries when they last took place in 2019.

Visitors to the Injection Molding and Design Expo will include injection molders, OEMs, Tier Ones, brand owners, design consultancies and mold makers, all operating within a wide range of end-use markets. These include the automotive, packaging, electrical and electronic, medical, industrial and consumer sectors.

They will have access to three free conference theaters – one focused on Molding The Future, one on Designing The Future, and a third featuring a series of practical training seminars. The high-level programs will be curated by the expert conference, editorial and business intelligence teams at AMI and Crain.

Ideal location

Rita Andrews, AMI's head of exhibitions, explained the reasons for selecting the Detroit venue: "It's the ideal location for the Injection Molding and Design Expo because of the very high concentration of molders in Michigan and neighboring states, along with the importance of Detroit as a center for automotive design and production, plus the proximity of the mold making cluster across the river in Windsor, Ontario".

Exhibitors at the event will include suppliers of: injection molding machinery; auxiliary equipment; automation systems; molds; hot runners; machine and mold components; plastic resin and compounds; additives, masterbatch and liquid colors; design and analysis software; and a wide range of industry services.

For more information about exhibiting at the Injection Molding and Design Expo 2022, or to register your interest in a free ticket, please visit: https://go.ami.international/imd-expo-register-interest

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MTA takes in its 100th Engel

MTA, a maker of automotive fuses, has just received its 100th injection moulding machine from Engel over the course of a 25-year partnership. This was a Victory, the company's machine of choice at its main site in Codogno, northern Italy, where it operates nearly 60 Engel machines, and also at sites in Slovakia, Morocco and Brazil

MTA's products range from plug-in fuses, connectors, fuse holders and radiator caps to complete power distribution units for the general automotive, motorcycle, commercial vehicle and off-highway vehicle industries. The company said that the Victory's tie-bar-less clamping unit offers it "a clear-cut efficiency advantage" because "the short set-up times lead to a high utilisation of the machines."

› **www.engelglobal.com**

Oerlikon to acquire INglass and HRSflow

Oerlikon, the Swiss company specialising in surface engineering, polymer processing and additive manufacturing, has agreed to acquire Italy's INglass, including the HRSflow division, which makes hot runner systems. The deal is expected to be completed within the second quarter, subject to regulatory approvals and closing conditions. Terms were not disclosed.

"The acquisition of INglass accelerates our strategy to expand into markets with strong growth potential. It will broaden our OEM customer base in other industries and put our polymer processing business on an entirely new growth trajectory," said Roland Fischer, CEO of Oerlikon, which has 10,600 employees and had sales of CHF2.3bn in 2020.

Oerlikon added that INglass's polymer flow control technology is "highly complementary" to its existing capabilities in this field and should create further synergies between its Polymer Processing and Surface Solutions divisions. The former had hitherto been known as Manmade Fibres, and has now been renamed as a direct result of the acquisition.

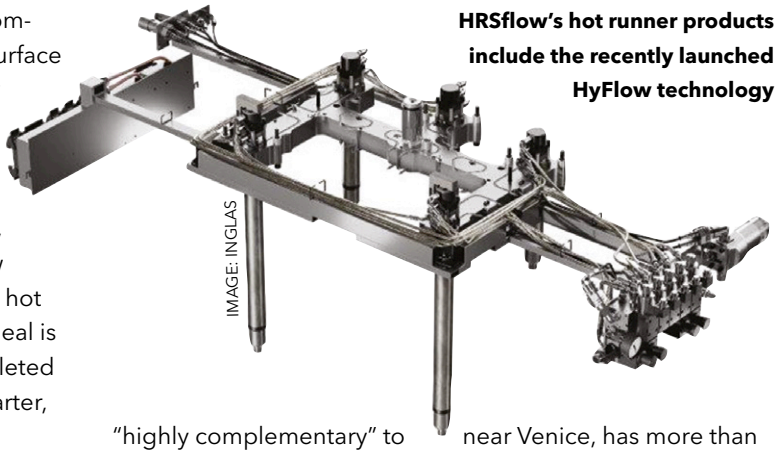

IMAGE: INGLAS

HRSflow's hot runner products include the recently launched HyFlow technology

HRSflow will be integrated into the Flow Control Solutions business unit, which forms part of Polymer Processing. This business makes gear metering pumps, mainly for the textile, automotive, chemical and paint markets.

INglass, which is based near Venice, has more than 1,000 employees and 55 sites worldwide, including production plants in Italy, China and the US. Sales were about €123m last year.

The HRSflow hot runner systems are used by injection moulders in industries including automotive, consumer goods, household appliances, packaging, waste management, construction and transportation. INglass also offers engineering and consultancy services for the development of polymer processing products.

› **www.oerlikon.com**
› **www.inglass.it**

Aptar works with Claranor on closures

Dispensing systems maker Aptar Food + Beverage has formed a technical collaboration with Claranor, a specialist in pulsed light packaging sterilisation. Under this Claranor's Fullcap sterilisation system will be used with the translucent material version of Aptar's Uno PP sport closures.

Fullcap goes through the closure, allowing sterilisation under the cap, such that chemicals cannot pass through and the integrity of both product and package are maintained. It is adapted for high-acid aseptic lines.

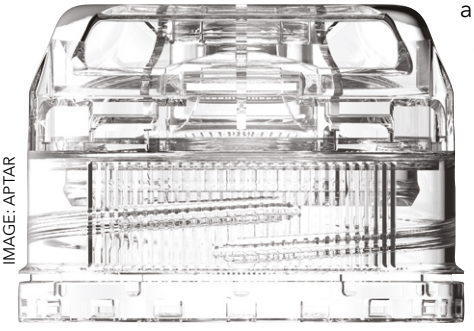

IMAGE: APTAR

Above: Aptar's Uno PP sports caps

Aptar said that Fullcap provides "ultimate inner and outer decontamination" for Uno PP sports caps. This is a one-piece design that is made in PP and aimed at aseptically processed, shelf-stable beverages, such as preservative-free functional drinks. Aptar's Uno 38mm 3S is used in Oshee's new functional drink in Poland.

› **www.aptar.com**

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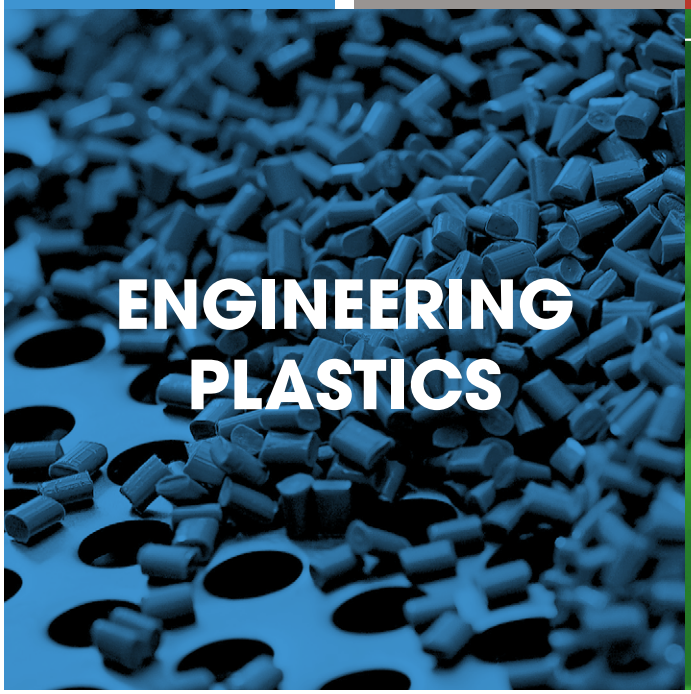

Plastics Engineer

www.tisan.com.tr

Wirthwein builds production hall

Injection moulder Wirthwein is building a new production hall at its headquarters in Creglingen, Germany, in anticipation of renewed demand.

The hall is to be built on the site of the former sawmill where the business first started in 1949, and should be complete in August. The total cost will be around €10m.

IMAGE: WIRTHWEIN

Wirthwein executives and others, including the local mayor, at the groundbreaking ceremony

Measuring 90 m long by up to 45 m wide, the L-shaped hall will dock onto the existing production hall and will have a total floor area of around 3,000 m². There will be a truck loading ramp in the rear part, plus offices and other facilities in the front. A second phase expanding the office wing is already planned.

In addition to the new hall, Wirthwein is installing an overhead crane and a machine park housing seven injection moulding machines and associated peripherals. In addition, there are various shelves and features for the storage and maintenance of tools as well as for QA requirements during series production.

In 2020, Wirthwein closed its Eichenzell plant after a 10% fall in sales, which was particularly marked in the automotive and household appliances markets. The medical technology sector was booming, while the rail and interior design markets were described as "solid". Since the late summer, the group said it "has recorded more stable calls and even a hint of catch-up effects", with orders coming in from both new and existing customers.

› **www.wirthwein.de**

Faurecia sees Q1 sales growth

France-based Faurecia, the Tier One supplier to the automotive industry, has reported first-quarter sales of €4,005m. These were 8.9% up on the same quarter of 2020 on an organic basis or 12.2% up at constant scope and currencies. The figures exclude the Acoustics & Soft Trims division, which is being sold.

The growth was achieved despite a "significant unfavourable geographic mix effect" – Faurecia is underrepresented in Asia, the strongest general growth market in the automotive industry – which dragged down sales by about 5%.

The company saw double-digit organic growth for its Seating, Interiors and Clean Mobility businesses and 5.7% for Clarion Electronics, despite the ongoing global shortage of electronic components. Geographically, growth was particularly strong in China, where sales exceeded Q1 2019 levels, and they were also strong in Europe.

On the basis of strong growth forecasts in vehicle production, a turn-around in the geographic mix effect and gradual ramp-up of new capacity for the Seatings business, Faurecia has confirmed its full-year financial targets. It expects to achieve €16.5bn in sales, operating margins of about 7%, close to pre-Covid levels and a net-debt-to-EBITDA ratio of under 1.5 at year-end.

› **www.faurecia.com**

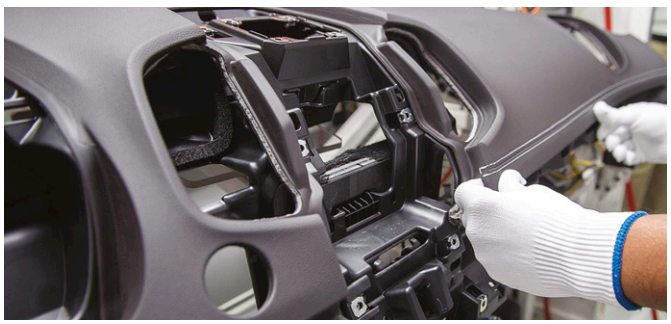

IMAGE: FAURECIA

Above: Faurecia IP production and assembly

Resilux increases recycling

In response to growing demand, Resilux, the Belgian PET bottle and preform producer, is doubling the bottle-to-bottle PET recycling capacity at its Group Recycling Competence Centre at Bilten, Switzerland.

To achieve this, it has invested in a Vacunite food-grade PET recycling system from Erema. The company said that this reinforces its "commitment to making a complete sustainability loop".

› **www.resilux.com**

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ARX buys Promens Zlin

Private equity firm ARX Equity Partners has acquired Promens Zlin from Berry Global, subject to customary closing conditions. As part of the investment, ARX has agreed to work with the existing management team, who will continue to lead its development.

Based at Zlin, Czech Republic, Promens Zlin is a Tier One systems and development supplier. It focuses mainly on large exterior and interior parts for buses, earth moving vehicles and agricultural equipment, and its main technical expertise lies in reaction injection moulding and vacuum forming.

Promens Zlin added that it is currently undergoing a "substantial" capital expenditure programme to expand and modernise its facility, in order to meet growing demand. In the last fiscal year, it had sales of about €37m.

› **www.promenszlin.cz**

Polykemi to invest €10m to manufacture in US

Polykemi is to invest close to €10m to set up its first production plant in the US. The plant, which will be located at Gastonia in North Carolina, will start up in 2022 and will be the Swedish compounder's largest ever single investment.

The company has been active in the US market since 2013 working with toll compounding partners but the long term plan has always been to have its own production capacity. "The whole time, our goal has been to start up production in the US, and we have now reached that milestone. The new plant is geographically close to our existing customers, which gives us a clearer presence and even stronger customer relationships," said Johan Hugoson, CEO of the US business.

IMAGE: POLYKEMI

Above: Polykemi's planned US production site is its largest ever investment

The new facility will initially cover 4,600m² but the site will allow expansion to 9,200m². It will start production with two production lines – 75mm and 90mm – ramping up to a full complement of six. The intention is to produce virtually all the compounds it currently manufactures at its sites at Ystad in Sweden and Kunshan in China.

"This is an investment in the future and lays the ground for Polykemi Group's future growth," said Hugoson.

Polykemi Group recorded sales of around €140m for 2019 and had a capacity of around 65,000 tonnes.

› **www.polykemi.se**

Arkema's new PA 11 site on track

Arkema still expects to start up production of Rilsan PA 11 at its Jurong Island facility, Singapore, on schedule in the first half of 2022 after overcoming Covid-related difficulties.

The material, derived from castor bean oil, will increase the firm's global PA 11 capacity by 50%.

The company added that this will be the biggest integrated biofactory in the world to be dedicated to high performance polymers. The total investment, including downstream polymer capacities in China, will be about €450m.

› **www.arkema.com**

Landmark expansion for Evco in Georgia USA

With the purchase of a new 3,700 m² facility near its existing CAL 1 site at Calhoun, Georgia, US custom injection moulder Evco Plastics will bring the total space at its ten plants worldwide to over 1m ft² (930,000 m²).

The new facility, known as CAL 2, will begin operations in the autumn. It is food-grade compliant and includes white room and LSR moulding capabilities for medical and commercial lighting applications.

CAL 2 has room for 20 injection moulding machines up to 500 tonnes, plus a separate room for new LSR machines. Other features include: two bridge cranes for setting moulds in presses; four material silos; a 2,000 m² white room; a 195 m² LSR production room; 67 m² metrology room; and highly automated lights-out production.

Evco is also adding 1,200 m² of extra space to its headquarters AMP facility at DeForest, Wisconsin, providing room for machines and larger amounts of raw materials and finished goods.

› **www.evcoplastics.com**

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Thermoplastic elastomers are in big demand in medical products such as face masks. ***Peter Mapleston*** *writes about new soft plastics, including some containing recycled and bio-based materials*

IMAGE: LUBRIZOL

Main image: Lubrizol Estane Silk 91T70 used in a watch strap application

TPE development guided by Covid and sustainability

The Covid-19 pandemic has helped bring a surge of interest in soft thermoplastic elastomers (TPEs), for various pieces of personal protective equipment (PPE). But it is not the only growth driver. TPE suppliers are also helping specifiers in multiple markets wanting to increase sustainability, developing materials with higher levels of recyclate, or based on renewable resources.

In the USA, **United Soft Plastics (USP),** which specialises in production of TPE compounds, reports a surge of interest in the use of TPEs for the production of many Covid-19-related medical applications, including face masks and face shields, and also ventilator parts.

USP expects this demand to drop gradually during the year, but Rudi Herbst, President, CEO and Chairman of the company, says there will still be more long-term support for these medical products than existed before the pandemic, particularly due to the growing use of antimicrobial, antiviral, and antibiotic compounds. Covid-19 has caused a spike in interest both in replacing crosslinking rubbers with TPEs in current applications and in scaling those applications for the future, says Herbst.

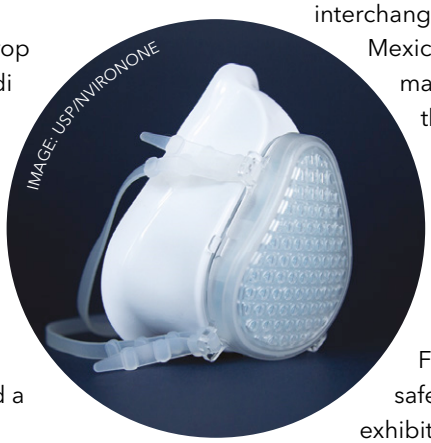


IMAGE: USP/NVIRONONE

Left: Face masks, such as this Nvironone OvaOne interchangeable-filter face mask, are consuming increasing amounts of TPE

"We see a larger fraction of consumers become more conscious of infectious disease and the ability that we have, both as manufacturers and consumers, to prevent the spread of disease through the choice of proper materials," he says.

The result is that many applications which previously were not considered "medical" (he cites a pen cup in a public waiting room) will in the future need to hold up to different sterilization methods such as contact sterilization, according to Herbst.

An example of custom-developed TPEs for face mask applications is one supplied through USP's Mexican subsidiary for the Nvironone OvaOne interchangeable-filter face mask from Mexican manufacturer Nvironone. The mask has three containment plates that progressively block the dispersion of droplets and utilises an N95 filter that prevents the spread of aerosol particles. The injection moulded material for the mask's base structure is designed to meet FDA contact requirements and is safe for skin contact. The TPE exhibits high tear strength and a smooth surface finish. "Despite the challenging business environment due to the pandemic, we've enjoyed strong growth in Mexico thanks to

Right: Menstrual cups in TPE made by Zylog

applications like these," says Tomasz Nowinski, General Manager of USP de Mexico.

Herbst says USP's Unisoft Special and Medical Series grades are highly suitable for masks and shields because they provide excellent elasticity, strong recovery properties, and tear resistance. Several million face shields have been made using USP materials for the straps.

USP, founded by Herbst in 2005 following a period at Kraiburg that saw him rise to President and CEO of its US operations, now has two plants in the US; Herbst is mulling a third outside the country. The company has developed some 4,500 grades based on a wide range of chemistries.

Hexpol TPE says the upsurge in Covid-related demand has led to an increasing need for translucent and transparent TPE materials for use in various kinds of face masks. Customers are looking for soft-touch materials with high levels of transparency that can be sterilized using various methods (see more on Hexpol TPE's work in the medical sector in the *Injection World* January 2021 medical feature).

Lower costs

Zylog, India's oldest TPE company, says the Indian government's Make in India focus and the need to reduce dependency on imports is driving developments of new applications. "We worked very closely with a medical device customer and tool maker to locally develop a menstrual cup for domestic and export markets," says company director Aschak Damani.

Silicone thermosets are a dominant material in this market, Damani says. "However, considering the need for lower cost for reaching the masses, while not compromising on health and safety of the user, the need was to develop the right TPE compound for injection moulding these cups, at a final component cost point of less than US$0.50. The challenge was to meet biocompatibility, re-use

Below: TPEs can be critical in medical syringes

Typical Properties	Neoflex 8140
Density (g/cm^3)	0.90
Shore Hardness	43 A
100% Modulus (MPa)	1.0
Tensile Strength (MPa)	8.0
Elongation (%)	900
Tension Set - 300 (%)	20
Compression Set (%)	28

Selected properties of Neoflex 8140 SBC-based compound from Zylog

durability, non-latex materials, recyclability at end of life, very high resiliency, very low compression set and non-deformation/shape retention over extended use, even during disinfection in boiling water."

Zylog developed a low hardness medical TPE grade based on an SBC, providing, Damani says, excellent resiliency and compression set properties, while meeting all performance criteria and complying to US FDA CFR 21, EU Regulation 10/2011, EN 71/3, RoHS and REACH requirements. "The formulation is designed to meet high productivity and throughput on multi-cavity injection moulding tooling, while providing a non-tacky, translucent, smooth feeling component."

Zylog, which also manufactures sheets, skins and laminates based on TPEs and TPOs, and is further forward integrated into thermoformed parts and components, exports across Asia, Middle East, and Africa.

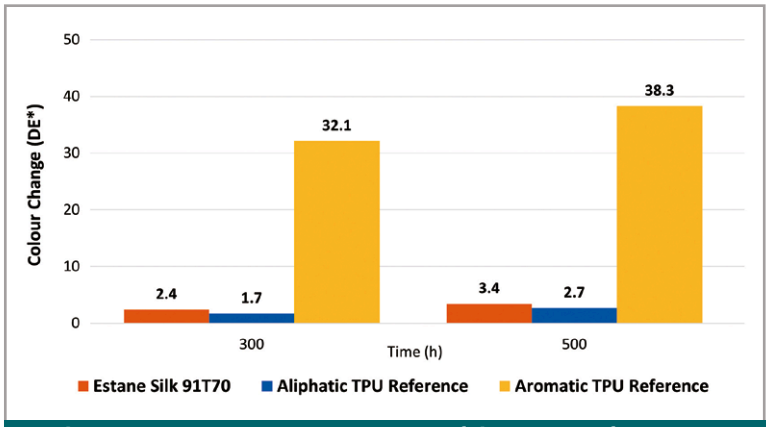
Kraiburg TPE, too, has recently witnessed an increased demand for extremely soft compounds, but not only for medical applications. "With focus applications such as cycling equipment, orthosis, fishing baits and wheelchair cushions in mind, we decided to upgrade the already existing tested and approved Supersoft TPE and introduce a series of new compounds, all fit for current and future

requirements: Thermolast S," it says.

These TPEs set a new benchmark due to their wide processing window, the supplier says. Compounds are processable with a melt temperature ranging from 180°C up to 250°C, with a mould temperature between 30 and 50°C without sticking in the mould (even without any special mould coating). Long flow paths can be achieved, even with low injection pressures. The colourable materials can be 3D printed as well as injection moulded.

Earlier this year, **Avient** unveiled the Versaflex CE 3130 series of TPEs, which it says are engineered to overcome the challenge of surface blooms on over-moulded consumer electronics. Blooming is the result of improper injection moulding conditions or the incompatibility of a material with certain additives. "Our new developed formulation can balance the polymer and additives perfectly, and together with our processing guidance, the bloom problem can be addressed," says a company representative.

Avient says the new materials provide a "premium, silky-soft over-moulded surface [and] also offer critical UV and stain resistance to endure



Weathering resistance (QUV ASTM G154) of three types of TPU
Source: Lubrizol

everyday wear and tear. Because they over-mould onto PC and PC/ABS with a smooth surface, they eliminate the need for secondary coatings. In addition, the materials' outstanding mould release improves cycle times, reducing overall energy use."

Lubrizol Engineered Polymers says it is responding to calls for softer, more sustainable materials with faster processing speeds. Estane Silk 91T70, an aliphatic thermoplastic polyurethane (TPU), can be used to mould parts with smooth, soft

IMAGE: AVIENT

Right: Avient is helping old fishing nets to be recycled into new TPEs

surfaces, as well as having very good weathering resistance and processability. "The new development bridges the performance between silicone rubbers and TPE alternatives (like COPE, COPA)," the company says. "While maintaining the long-lasting durability, abrasion and resilience recognised in TPUs, it adds comfort, design flexibility, and recyclability."

Estane Silk 91T70 has a Shore A hardness of approximately 70. Lubrizol says excellent mould release properties contribute to a reduction in cycle time of some 25% compared with other TPUs. It can be over-moulded onto polycarbonate and polyesters. It is easy to colour and recycle, with compounds containing up to 30% recyclate still maintaining colour and mechanical performance, Lubrizol says.

Up to 40% PIR

The choice of TPEs already containing recyclate continues to grow. For example, Kraiburg TPE says its new RC/UV series addresses demanding requirements for automotive exteriors such as weathering resistance and a high surface quality, while containing up to 40% of post-industrial recycled (PIR) materials. Applications are also envisaged under the vehicle and under the hood: water tank covers, air duct parts, wheel arch liners, drip rails and window encapsulations, for example.

The compounds can be over-moulded onto polypropylene. The low density of the new compound series allows weight reductions of up to 25% as compared to some other TPEs, Kraiburg TPE claims.

Recyclate also figures in new TPEs from Avient. Last year it launched several portfolios of post-consumer (PCR) and PIR materials – TPEs, polyamides, and polycarbonates – under the reSound R brand name. TPEs, called reSound R VX and currently only available in North America (with global availability under evaluation), contain up to 25% PCR and up to 40% PIR; both can be over-moulded onto polypropylene.

The PCR grades are formulated with recycled ocean plastics from Oceanworks, a participant in the Alliance to End Plastic Waste, a non-profit group that includes Avient as a founding member. They are formulated for consumer applications, such as personal care products, lawn and garden tools, outdoor goods, office supplies, footwear, and houseware durables.

At the beginning of the year, **Audia Elastomers** launched AudiaFlex TPEs, which also include grades derived from ocean waste, as well as other PCR, PIR, and bio-based sources. Frank Axelrod, Vice President of Sales & Marketing, says the company is "responding to legislation on single-use plastics, growing consumer demand for sustainable products, and the commitment from brand owners to achieve sustainability goals over the next five years."

AudiaFlex OP grades are based on marine waste plastics – beach clean-up materials, commercial fishing gear, and ocean-bound plastics. Included are products with up to 45% marine waste and 70% total recycled material content. The AudiaFlex PC line has grades derived from defined supply sources with consistent colour (yogurt cups for example); they can be used for food contact applications. AudiaFlex PI materials incorporate 5-70% post-industrial recyclate. AudiaFlex Bio grades have bio-based contents ranging from 5-90%. All four ranges have grades in hardnesses

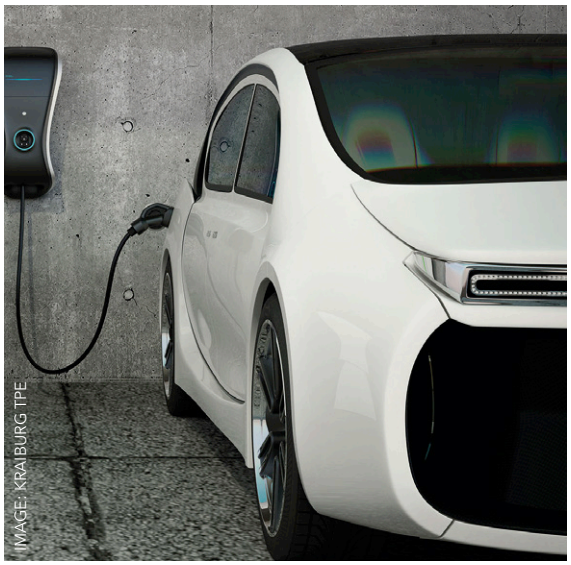


IMAGE: KRAIBURG TPE

Right: RC/UV series TPEs containing post-industrial recyclate enable OEMs to contribute to the circular plastics economy, says Kraiburg TPE

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ranging from 20 to 95 Shore A.

AudiaFlex materials are said to be able to compete in high-performance applications with conventional TPEs, TPVs, and TPU chemistries in personal care, consumer household, consumer electronics, automotive, and toys. They are produced at Audia facilities in Lafayette, US, and Shenzhen, China.

Mocom, the compounder that was previously a division of Albis, is expanding its TPV portfolio with a new product line called Alfater XL Eco, containing several new PP+EPDM grades based on high-quality PIR PP. Formulations with bio-EPDM are also available on request. Various Shore hardness are available. Mocom says grades combine sustainability with the typical TPV properties, such as a low compression set (also at high temperatures) and good heat aging resistance.

The content of PP recyclate depends on the hardness and can be higher than 80% for Shore D50 grades. According to Stefan Zepnik, Director of the Mocom Technical Service Centre, this enables CO_2 savings of about 50% in comparison to a virgin or prime TPV with Shore D50.

Alfater XL Eco is suitable for 2K molding and demonstrates excellent bonding to polyolefinic materials. The new grades are suitable for the manufacture of automotive components, including under-the-hood as well as exterior parts. Further potential is seen in such diverse applications as profiles, seals, casters, dampers and protectors, grips, and soft-touch applications.

Bio-based TPEs

Hexpol TPE is also addressing sustainability issues on several fronts. It already has compounds containing recyclate, but more recently it has been adding to its Dryflex Green family of bio-based compounds. The series now includes grades based on TPS (styrenic block copolymer TPEs and also TPO modified polyolefin – not TPEs in the strictest sense) technologies, with amounts of renewable content up to about 90% (ASTM D 6866-12). Hardnesses range from 15 Shore A to 60 Shore D.

IMAGE: KRATON

Above: The Buick GL6 is the first mass-produced car in the world to take advantage of Kraton's IMSS technology for production of large thin-walled soft-skin parts – in this case the instrument panel

Dryflex Green TPE compounds are made using raw materials from renewable resources such as by-products from plant and vegetable crop cultivation. Hexpol says they can usually be used as a drop-in solution, without the need for tool modifications. They display mechanical and physical properties comparable to TPE compounds from fossil-based raw materials. They also show very good bonding behaviour to PE and PP, with special grades for bonding to ABS, PC/ABS and PET. Hexpol says they are easy to colour, and grades are available with raw materials that are compliant with food contact regulations.

"Alongside our TPEs with recycled content and biocomposite compounds, we are developing an extensive portfolio of resource-saving materials,"

New SealCare TPEs from Benvic

PVC compounds producer Benvic has launched the SealCare product line based on a thermoplastic elastomer compound which it is targeting at food and beverage applications. The SealCare range currently consists of general purpose grades, TPE086 and TPE088 oil free, for crown cork closure liners.

"This new product fits perfectly with our strategy of creating product extensions from our PVC base and history," says Glenn Tackacs, product manager for SealCare. "SealCare will become a leading part of our new Xtended materials product line – in addition to ProVinyl, Plantura and Medical."

The SealCare TPEs have been optimised to deliver improvements in sealing which helps customers to offer closures with superior material properties and to improve their productivity, says Benvic. Development involved researching the desired materials with machinery makers.

"SealCare has been thoroughly assessed and approved by global leaders in machinery manufacturing and converting," says Takacs. "Close collaboration with several closure manufacturers has already made our product a solution which will meet both performance and cost optimisation."

Benvic says the TPEs development demonstrates its engineering know-how beyond PVC, able to sustain the position of a solution provider across a variety of polymeric materials.


IMAGE: HEXPOL TPE

Right: Hexpol Dryflex HiF TPE skin and PP carrier back-foamed with PUR

says Global R&D Manager Klas Dannäs. "We continue to trial new and emerging raw material combinations."

Sustainability also figures strongly in the story of **Kraton Corp's** development of its IMSS (Injection Moulded Soft-Skin) technology. A few months ago, it announced the first commercial application of IMSS in an automotive application – the instrument panel on the 2021 Buick GL6, built for the Chinese market by SAIC-GM, the Chinese joint venture between General Motors and SAIC Motor Corp.

IMSS technology is based on ultra-high flow hydrogenated styrenic block copolymers (HSBCs). Kraton says it allows injection moulding of large, thin-walled soft skin parts and also provides lower odour, fogging, VOCs, better aging, subsequently improved safety performance, and lower specific gravity than commonly used PVC soft skins. Kraton unveiled the technology a few years ago (see TPE feature in *Injection World* May 2018).

Soft skin

Kraton says the production of instrument panel soft skin with an injection moulding process can help automotive interior manufacturers avoid the high-cost, labour-intensive, and energy-consuming slush moulding process. Additionally, the injection moulding equipment offers higher efficiency, lower cost, and less energy consumption.

The time needed for making an IMSS skin by injection moulding can be as low as one-fifth of that required for making a PVC soft skin of similar size by slush moulding. Injection moulding tools last longer than electroformed slush moulds, and Kraton claims development and manufacturing costs of IMSS skins are lower than PVC slush.

Below: Prototype instrument panel skin injection moulded in a compound based on Kraton IMSS technology

The IMSS compound used to manufacture the Buick GL6 instrument panel soft skin was developed and is supplied by Dawn New Materials in China. The company worked in close cooperation with Kraton as a technology transfer licensee of the IMSS technology. Kraton is also working on establishing technology licences with several other compounders worldwide.


IMAGE: KRATON CORP

One such compounder is Hexpol TPE. It recently launched the Dryflex HiF family of very high melt-flow and scratch resistant TPS-SEBS materials, incorporating Kraton IMSS technology. Hexpol says the grades open possibilities to produce large scale parts via injection moulding, including automotive interior surfaces, trims, and skins.

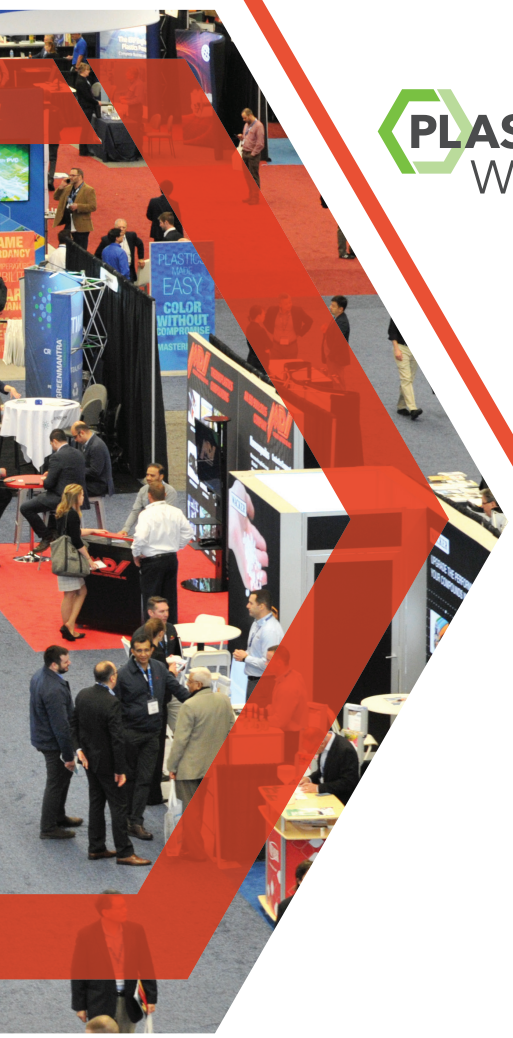
Group product manager Dr. Thomas Köppl says: "Until recently, TPEs have not been viable for large scale trim because these applications have much higher specifications regarding abrasion behaviour, processability and heat resistance. The new Dryflex HiF TPE grades fulfil these requirements and are injection mouldable, making them an interesting alternative to PUR coating, PVC slush moulding or TPO foil processes."

Hexpol has carried out a production trial in which 1.1 mm thin skins for the soft surface of a complete instrument panel were successfully injection moulded and back-foamed with PUR.

According to Köppl, testing demonstrates that Dryflex HiF TPEs pass the stringent lightfastness and heat resistance requirements for instrument panels (for example 120°C for 1,000 hours). "A low-gloss, matt surface with no visible weld lines is achievable as well as the moulding of different leather grains. Surface performance is confirmed by the testing of Erichsen scratch resistance and Crock abrasion. The lower density of Dryflex HiF TPEs (0.9 g/cm^3) can decrease part weight."

Dryflex HiF TPEs can be used in multi-component applications with direct over-moulding to PP. Compared to existing TPU or PUR-RIM processes, which often use PC/ABS as the rigid component, the material's ability to adhere to PP can deliver further cost and weight reduction in 2K processes, Köppl concludes.

For automotive applications mostly under the



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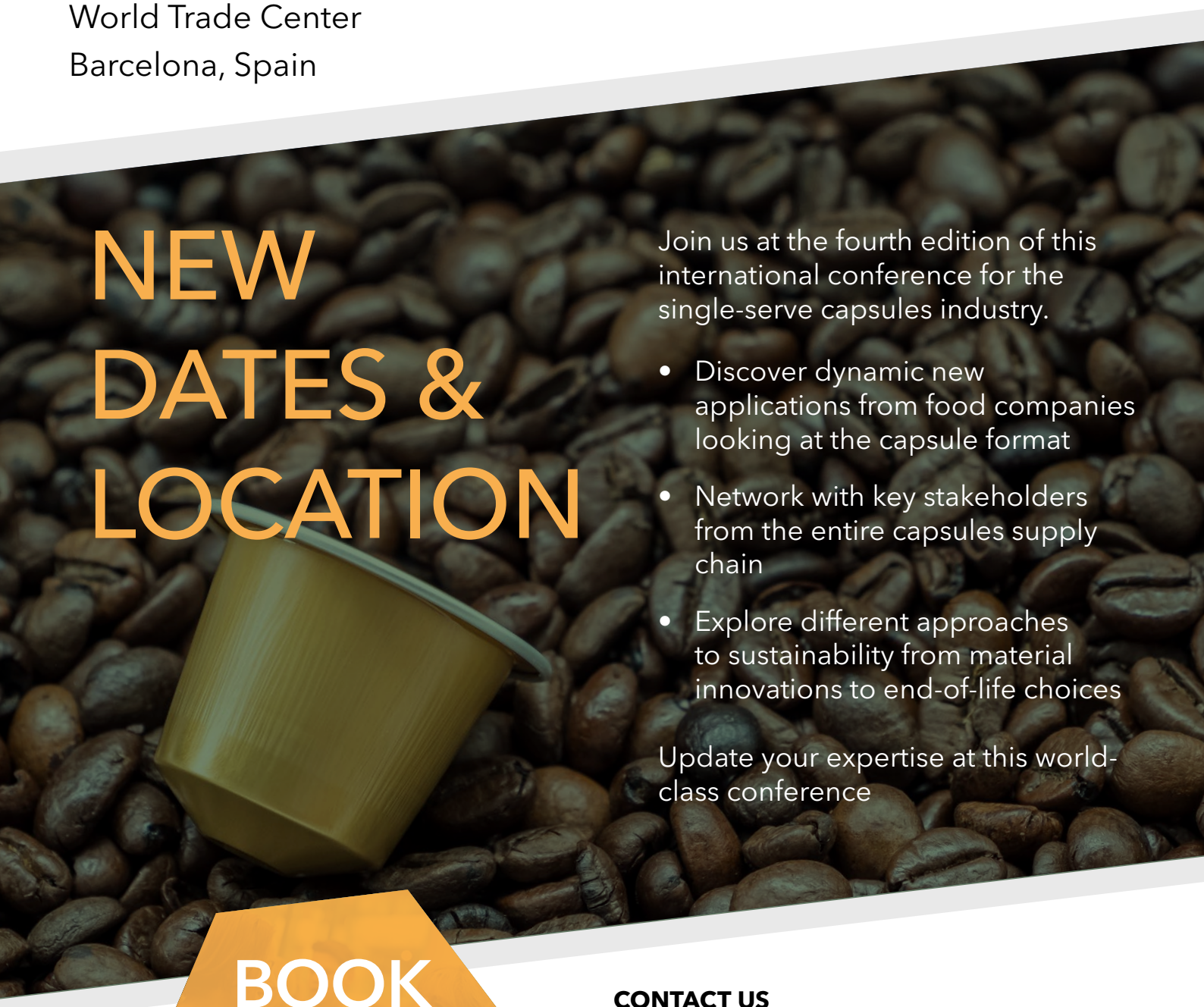

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hood, **RTP Company** has released Nylabond 7091, describing it as a unique material formulated specifically for components that are exposed to high temperatures and aggressive fluids, effectively bridging the gap between traditional thermosets and underperforming thermoplastics. "Although engine compartments and components keep getting smaller, exposure to heat and fluids are still issues to mitigate," it says.

Novel TPV

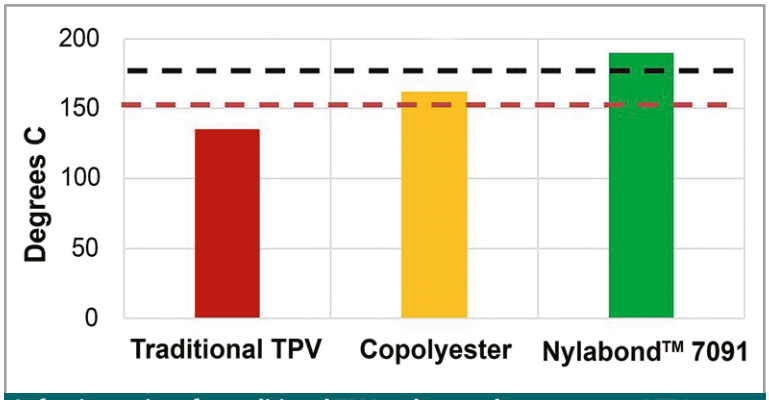
Nylabond 7091 is a TPV, but differs from traditional types, based on PP and partially vulcanised EPDM rubber. "It uses the highest performing rubber for heat and fluid resistance, vulcanised with a thermoplastic engineering resin," says Brian Gumbko, Global TPE Market Manager. He does not identify the rubber, nor the thermoplastic, although it can be assumed from the name that the latter is a polyamide.

Historically, thermosets and TPVs capable of withstanding 125° C environments have been specified for automotive under-hood parts, Gumbko says. "However, many of these same components are now required to withstand long-term exposure to 150 °C in air and fluid immersion for the life of the vehicle or component. As a result, many part specifications have been written to require materials to withstand 2,000 hours or longer continuous exposure to 150°C hot air and oil. Spike temperatures of up to 175 °C can also be experienced in extreme under-hood conditions."

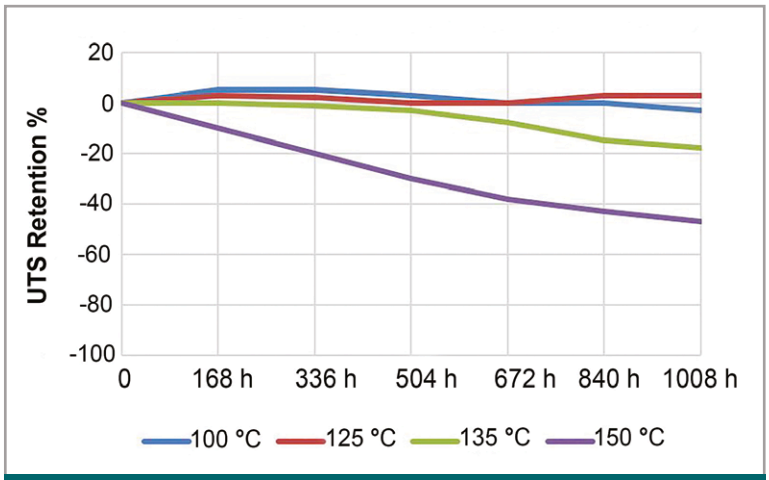
He says: "For applications with 150 °C exposure, like air/fluid transport systems, vibration/isolation dampening, and sealing, thermosets such as vinyl methyl silicone (VMQ), polyacrylate (ACM), and ethylene acrylates (AEM) were traditionally used due to their cost-performance balance; but their performance was lacking. VMQ cannot be considered an oil-resistant material; ACM and AEM suffer from long overall cure cycle and high specific gravity after compounding. Finally, thermoset elastomers are not readily recyclable."

Gumbko says: "Nylabond 7091 series materials can mimic thermoset properties and withstand long-term exposure to the most aggressive automotive fluids – engine oil, transmission fluid, and lubricating greases – for the life of the vehicle, even when those fluids are hot, making it one of the world's highest performing thermoplastic elastomers."

Nylabond 7091 materials, which can also be blow moulded, suit a wide range of applications, including automotive boots, transmission components, exclusion seals, air intake ducts and charge-air cooler ducts, and vibration isolators/mounts.



Softening point of a traditional TPV and a copolyester versus RTP's Nylabond 7091
Source: RTP Company



Long term heat resistance (ultimate tensile strength retention) of RTP's Nylabond 7091 at various temperatures
Source: RTP Company

RTP says the Nylabond7091 Series is far superior to conventional TPEs, polyamide elastomers, and copolyesters in applications that require exposure to automotive fluids. "In fact, tests show that components made from Nylabond 7091 far outperform components made of silicone rubber and copolyester when exposed to oils and lubes at 150°C," it says.

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IMAGE: SHUTTERSTOCK

Engineering plastics speed ahead in automotive parts

*Using plastics to reduce weight and costs in vehicles is no longer enough. New materials need to meet increasingly more demanding under-the-hood applications. **Mark Holmes** reports*

Whether for conventional internal combustion engines or electric vehicle powertrains, the automotive industry is demanding increasing levels of performance from plastic components. OEMs are not only requiring lightweight solutions that can accelerate the replacement of metals, but these materials must be able to withstand a wide range of demanding environments involving extremes of temperature, water and chemical exposure.

Under-the-hood applications usually require enhanced temperature or media resistance, according to **Wittmann Battenfeld**. "This can be achieved by using today's high-performance thermoplastics," says Marco Moser, Application Engineer and product expert for lightweight technologies. "By combining these polymer materials with our lightweight technologies Cellmould and Airmould, manufacturers can reach the required material properties and additionally achieve a significant weight and therefore cost reduction."

He continues: "Cellmould is a physical foaming technology used to produce automotive case parts such as foamed motor covers and car battery covers, as well as automotive structural parts, for example. With the technology you receive a foamed, closed-cell core surrounded by a compact outer layer. On the other hand, Airmould is a gas assisted injection moulding process to produce rod-shaped parts with a hollow inner section, for example automotive media ducts. With the whole transportation industry looking to minimise weight, these technologies can contribute to this and provide an overall environmental solution."

The Cellmould foaming process involves pressurised nitrogen gas, which is injected into the plastic melt inside the barrel of the Wittmann Battenfeld injection moulding machine during metering and is finely distributed. Due to the high

Main image: Under-hood materials must deal with exposure to temperature extremes

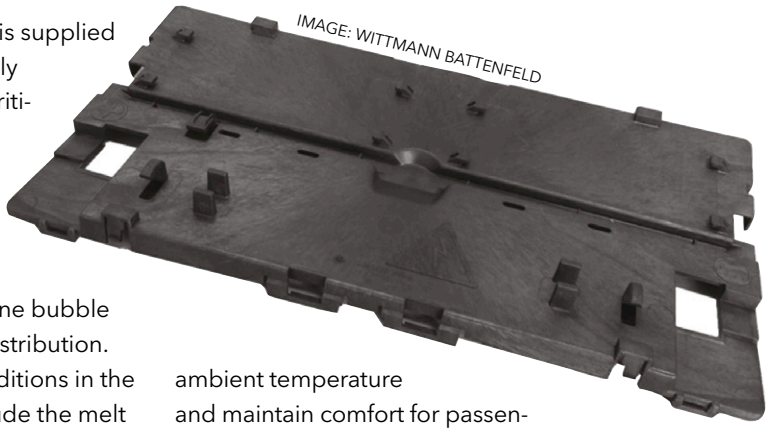
IMAGE: WITTMANN BATTENFELD

Right: A car battery cover made with Cell-mould technology from Wittmann Battenfeld

pressure of up to 330 bar, the nitrogen is supplied in a kind of liquid form and subsequently dissolves in the plastic melt as a supercritical fluid. When injected into the vented cavity of the mould, the pressure is released into the melt. The plastic/nitrogen blend separates again. Simultaneously, the supercritical fluid returns to its gaseous state, forming a fine bubble structure based on its homogeneous distribution. Its actual structure depends on the conditions in the injection moulding process. These include the melt viscosity of the plastic material, injection speed – the higher the speed, the finer the foam structure – and finally the quantity of material – the less plastic, the more space is available for the formation of a foam structure with material reduction. The material quantity is achieved by either an appropriately lower dosing for a fixed cavity or completely filling the cavity and subsequently opening it by a pre-determined high-precision opening stroke.

The company says that as well as weight reduction, other advantages include elimination of sink marks, reduced warpage and part costs, and lower tolerances. The process also provides higher rigidity with the same weight, longer flow paths through reduced viscosity, new design options, and lower internal mould pressure and clamping force requirements.

Airmould is the internal gas pressure technology that is used in several different process variants, depending on the part geometry, plastic material used and the specific requirements for the product. A distinction is made between the partial filling process, and the spill-over cavity process for the production of hollow parts, and the shrinkage compensation process. These differ from each other by their specific mould technologies and the equipment and control system of the injection moulding machine. All three process variants can be achieved with the modular Airmould gas supply system.

According to Wittmann Battenfeld, advantages include an improvement in quality and the elimination of sink marks and warpage due to shrinkage. There is also a reduction of the required clamping force, cycle time and weight, as well as additional scope for design.

For exhausted engine vehicles, noise reduction, efficiency and weight reduction remain major trends, reports injection moulding machinery manufacturer **Sumitomo (SHI) Demag**. "Additionally, for hybrid vehicles there is a focus on improving and regulating the thermal management of the temperature to ensure the system can adapt to the ambient temperature and maintain comfort for passengers," says Nigel Flowers, UK Managing Director. "In all-electric vehicles, current trends are focused on improving the protection of the current. Materials like Duroplastics are experiencing a renaissance. Additionally, the vibration and resonance behaviour are totally different and consequently need a new selection of materials and part design."

He says: "As more complexity is added into vehicle electronics, demand for connectors, micro-gears and micro-switches is rising. In the fibre optics market, this particular technology is adopted for moulding gears such as micro connectors, ceramic holders and optics housings. Other applications comprise micro engines, micro drive control systems and micromechanics rotators."

Materials selection

Polyamide-based engineering plastics are widely preferred in under-the-hood applications across the automotive industry for their high heat, hydrolysis and oil resistance properties, according to **Eurotec** of Turkey. The properties of these materials should be enhanced and improved for resistance through special formulations so that they meet the required automotive specifications. With its recently developed 'A' series codes, the company says that it offers a material portfolio consistent with OEM specifications due the right-application-right-material selection principle.

Eurotec adds that superior mechanical properties, stipulated by OEM specifications for under-the-hood applications – such as motor cooling systems and drivetrains in conventional internal combustion vehicles – require the use of materials that are highly heat- and hydrolysis-resistant. These applications are functional components requiring consideration of their mechanical and thermal properties. For this reason, materials appropriate for long-term strength tests are preferred. The company says that it offers a wide range of technical polyamide engineering plastics with advanced mechanical and thermal properties intended for the automotive industry.

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PA 66 30% glass fibre reinforced products are used in applications such as radiator end tanks and cooling pipes, for example, due to their high hydrolysis resistance. Eurotec adds that it continues to enhance the properties of products in its portfolio with high performance materials in accordance with OEM specifications that require hydrolysis resistance at high temperatures for cooling system applications. To analyse the hydrolysis performance of its products, the company collaborates with a German independent testing body that carries out hydrolysis resistance tests for many OEMs.

Ethylene glycol is used as a cooling medium for heat removal in applications such as radiator end tanks, cooling pipes, oil filters, throttle caps and expansion tanks. The most crucial parameter to consider when selecting the materials used in these critical components is ageing in the presence of ethylene glycol at temperatures of 120-140°C. Along with hydrolysis resistance, there are certain other OEM specifications where thermal ageing performance is critical for applications requiring resistance to high temperatures such as 150-170°C. Eurotec says that it can offer products specifically formulated for engine component applications that are exposed to high heat and oil resistance throughout their life.

For electric vehicles, the temperature gap in the battery pack should be kept to a minimum while driving, in particular for the cooling system. An electric motor is driven from control units powered by the battery. Maintaining the battery temperature within the defined minimum-maximum operating temperature range is one of the most critical points regarding battery lifetime. Therefore, efficient operation of an appropriate cooling system is essential for electric vehicles. The company adds that the design of complex components featured in cooling systems necessitate the use of water- or gas-assisted injection moulding, as well as conventional processes. The advantages of water-assisted injection (WIT) systems, such as reduced cycle times and wall thicknesses, as well as improved surface quality, provide ease of design even for thin-walled parts.

Eurotec adds that for use in battery cooling systems, it has developed a material compatible with WIT systems, which withstands a temperature of 130°C and has improved hydrolysis and glycol resistance. Tecomid NB60 KG30 BK005 HV 0B is a PA6, 30% glass fibre/glass bead reinforced, heat stabilised, black compound, which the company says is ideal for cooling pipe applications due to its good surface quality and dimensional stability. It has passed both 120°C hydraulic oil tests required in OEM material specifications and the leakage, burst, cold impact and pressure pulse tests conducted on the final component.

Teknor Apex Company has introduced three halogen-free FR glass-reinforced PA compounds with UL-94 ratings of V-0, which provide high flow for injection moulding, good surface finish and improved property retention in comparison with standard glass-filled FR PA 66. Creamid grades A3H7G3, C3H2G4, and C3H2G6 are PA 66-based compounds with glass loadings of 15, 20 and 30%, respectively. Their non-halogen flame retardant formulations make possible compliance with European RoHS and WEEE directives as well as internal OEM requirements. Applications include under-the-hood automotive components requiring FR properties.

"Teknor Apex has drawn on semi-aromatic polyamide chemistry to enhance the ability of these compounds to retain tensile properties and stiffness upon exposure to moisture," says Mike Anderson, Commercial Director for the ETP Division. "The A3H7G3 product is currently in use for an automotive engine cover, having met an OEM specification for property retention after heat ageing at 170°C."

For the 20% glass-reinforced C3H2G4 grade, a comparison between dry-as-moulded and conditioned properties shows notched Izod impact strength increasing from 7 to 10 KJ/m^2; tensile strength decreasing from 125 to 85 MPa; elongation at break increasing from 3.0 to 3.4%; and tensile modulus decreasing from 8,300 to 5,500 MPa.

"The new Creamid compounds enable engineers to meet increasingly stringent requirements for halogen-free FR formulations while finding new ways to consolidate parts," says Pratik Shah, Director of strategic initiatives. "Included are

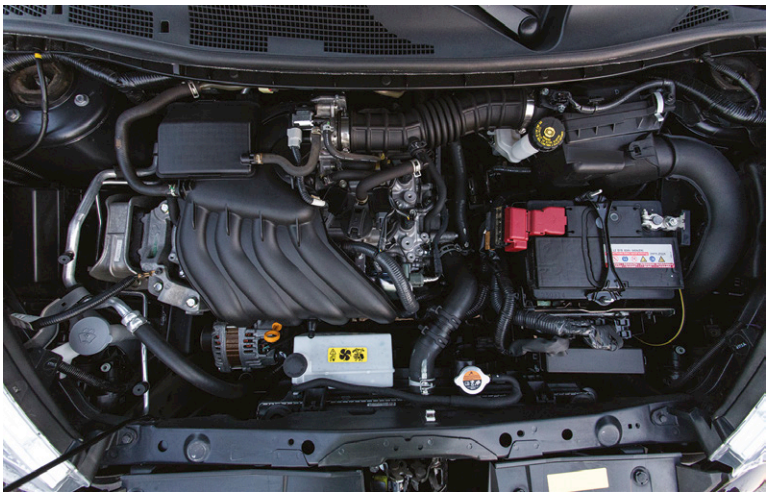


IMAGE: EUROTEC

Above: Eurotec says it is enhancing its PA materials in line with OEM specifications that require hydrolysis resistance at high temperatures

Creamid® Polyamide Compounds				
Properties (Units)	Test Method	C3H2G6 .1FRS	C3H2G4 FRSE	A3H7G3 .2S HFFR
Glass Content, %	---	30	20	15
Density (g/cm³)'	ISO 1183	1.43	1.36	1.30
Impact, Notched IZOD (KJ/m2)	ISO 180 / 1A	11	7	5.5
Tensile Strength (MPa)	ISO 527	155	125	105
Elongation at break (%)	ISO 527	4.0	3.0	3.0
Tensile Modulus (MPa)	ISO 527	10800	8300	6500
Flex Strength (MPa)	ISO 178	230	185	150
Flex Modulus (MPa)	ISO 178	9300	7300	5700
HDT @ 1.8 MPa (°C)	ISO 75-1	200	205	230
Flammability	UL 94	V0 (@ 0.8 mm)	V0 (@ 0.5 mm)	V0 * (@ 0.8 mm)

Typical properties of three glass-reinforced polyamides from Teknor Apex Company *Source: Teknor Apex*

grades with halide-free stabilisation that are designed for sensitive electronic applications, where ion migration can lead to failures of the electronic components. We continue to expand our portfolio of FR products in polyamides and other engineering plastics, such as PBT, PPA, and even PP, with several new grades in the final stages of commercialisation. Our vision is to have a polymer-neutral approach and provide an optimised solution to the individual customer problems."

RadiciGroup has developed Radilon Mixloy, a new range of PA blends for applications including automotive. The matrix material is PA and the new range is made by blending other polymers readily available on the market through a compatibilisation technology developed by the group, which makes naturally immiscible raw materials miscible. Radilon Mixloy products feature high-performance properties including thermal and mechanical resistance, and surface appearance. They also have low density, dimensional stability and ease of processing. Other advantages of these blends are low water absorption, improved tribological properties and low permeability (barrier effect). The company says that there are many fields of application, including engine compartment parts.

In polyphthalamide (PPA) materials, **Solvay** has introduced Amodel Supreme, a new line of high-performance compounds. Target applications are high-temperature automotive components used in electric drive units, including e-motors, power electronics, housings for high-temperature electrical connectors, electric and electronic devices and telecommunication equipment components that need excellent heat resistance. The materials also offer stiffness and toughness to replace metal in more traditional and structural applications such as clutch cylinders, shift forks and body in white.

Solvay says its new Amodel Supreme "features the PPA industry's highest glass transition temperature (Tg) of 165°C which enables higher mechanical performance vs. traditional PA 4T and PA 6T based materials at elevated temperatures. There is also a greater Coefficient of Linear Thermal Expansion (CLTE) match to metals that allows for ease in designing overmolded components."

The new PPA range features improved electrical properties, including volume resistivity and dielectric strength above 150°C. The materials also maintain electrical properties, like comparative tracking index (CTI), after exposure to high temperatures over time. The compounds were designed to ensure hydrolytic stability against new EV cooling fluids.

"Solvay continues to achieve new performance milestones for our Amodel PPA family of technologies to meet our customers' increasingly stringent requirements," says Brian Baleno, Head of Marketing-Transportation at Solvay Specialty Polymers. "Industries from automotive to electronics to telecommunications are raising the bar for properties such as heat resistance, strength, stiffness and electrical performance. Now, with the launch of Amodel Supreme PPA, we can meet or even surpass these high expectations and offer customers a new alternative to traditional metal and conventional polymers."

BASF has expanded its Ultramid Advanced PPA portfolio with carbon-fibre reinforced grades with fillings of 20, 30 and 40%. The company says that these new materials make lightweight parts and can safely replace aluminium and magnesium without loss in stiffness and strength and are electrically conductive. The new grades combine these properties with the advantages of Ultramid Advanced N (PA 9T), which provides high dimensional stability due to low water uptake, good chemical and hydrolysis resistance, high strength and modulus. The new carbon-fibre reinforced grades can be used to manufacture automotive structural parts for body, chassis and powertrain. With this offering, BASF complements its PPA portfolio of more than 50 grades already available on the market.

The mechanical performance of the new carbon-fibre reinforced PPA grades can be tuned by the choice and the content of the carbon fibre, as well as by the additive technology. Ultramid Advanced N3HC8 with 40% carbon fibre filling shows a better strength and modulus at 80°C (conditioned) than magnesium or aluminium. "Our new PPA compounds with carbon fibres are the ideal metal

replacement," says Michael Pilarski from PPA business management at BASF.

BASF has also introduced a heat stabilised Ultramid with heat resistance of up to 190°C for demanding environments. The PA 6 GF30 compound meets requirements for use in hybrid and electric powertrains. The company adds that engineering plastics must not only withstand high temperatures over a long period of time, but also prevent galvanic corrosion of electrical components. Heat resistance, good long-term use properties and weld resistance are the basic pre-requisites for components in current and future powertrains, whether in the internal combustion engine or hybrid and electric vehicles. With the development of heat-stabilised Ultramid B3PG6 BK23238, BASF is expanding its product portfolio of polyamides for the high-temperature range. The new P-stabilisation offers heat resistance of up to 190°C and prevents galvanic corrosion on electrical components due to its halogenide- and metal-free stabilisation, with a halogenide content of less than 50 ppm. The polyamide, reinforced with 30% glass fibres, also has good thermal ageing performance, as well as vibration and hot gas welding properties.

IMAGE: BASF

Above: BASF has expanded its PPA portfolio of Ultramid Advanced with new carbon-fibre reinforced grades

Tisan Engineering Plastics says that EV designers have turned to advanced polymers for electric insulation that do not compromise mechanical and dimensional properties. For EV parts, specialty compounds with lower initial mould-shrink and warpage tolerances are preferred. They also have lower moisture absorption for dimensional stability and come in UL 94 V-0 grades for flame resistance.

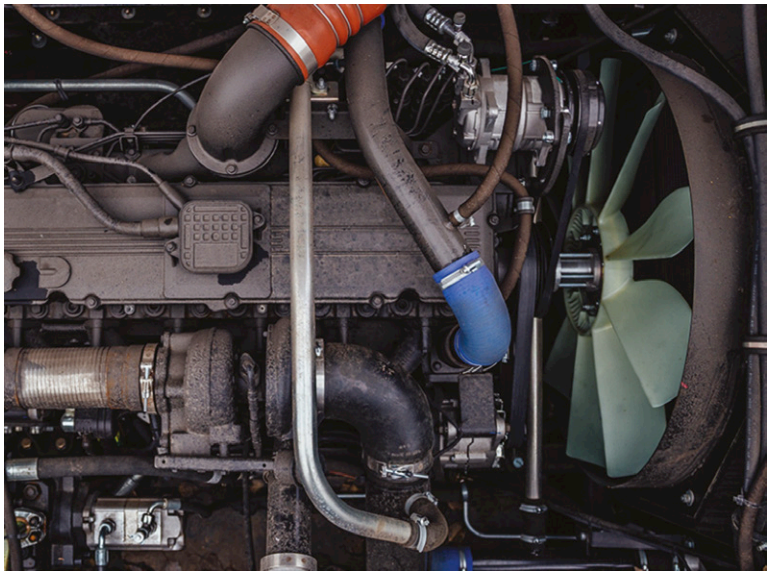
Tisan supports these efforts by formulating

engineering materials that provide strength, performance, lighter weight, flame retardancy, better efficiency and cost reduction for parts that are used in EVs. The company produces PA 6 and 66 compounds under the Tislamid brand name with standard and modified formulations for customer requirements. PA 6 compounds with short glass fibre reinforcement are used for EVs: Tislamid 66 with 30% glass fibre, hydrolysis- and heat-stabilised, and improved flame-retardant product – Tislamid 30D03 F01 K02 K06 R02 – is an example for an ion battery application in EVs.

The company offers a wide range of FR plastics that deliver the required electrical performance – Comparative Tracking Index (CTI), dielectric strength and a Relative Temperature Index (RTI). It has developed a new generation of FR compounds based on PA 66. Tislamid B 30D03 F01 Y01 HS R01 is a FR PA 66 with 30% glass fibre which is used in battery packs and drive assistant sensors. Tisan says it shows "excellent" mechanical strength, offers flame resistance classified as UL94 V0 up to 0.8 mm, and also maximum glow wire performance at 960°C.

In addition to PA materials, Tisan produces PBT materials for automotive parts used in very harsh environments where compounds need to have resistance to those environments. Its Tisester PBT compounds have low water absorption rates and possess the characteristic of maintaining insulation properties even in harsh environments, so they are used in many high voltage parts. To meet market needs such as these, Tisan developed Tisester PBT F 30D03 F01 K02 HS R01 (FR PBT, 30% glass fibre, heat-stabilised) which is used in thermal management systems and electric motor parts.

IMAGE: AVIENT



Avient has launched two new materials based on polyketone that it says can deliver comparable performance and lower production-related CO_2 levels than PA 66, PA 6 and acetal for use in under-the-hood applications

Avient has launched two new materials based on polyketone that can deliver comparable performance and lower production-related CO_2 levels than PA 66, PA 6 and acetal (POM), it says. Developed in response to current PA supply constraints, the company says that the new Edgetek PKE and LubriOne PKE series provide performance similar to PA 66 and PA 6. The speciality formulations combine good chemical and hydrolysis resistance to meet the challenges of harsh applications, such as those found in chemical, fuel contact or high-moisture environments. The new materials also offer sustainability benefits over the product lifecycle through carbon footprint reductions compared to competitive materials. Avient says polyketone base resin production emits up to 61% less CO_2 than PA and POM. Additionally, the new grades are formaldehyde-free, addressing VOC concerns in manufacturing compared to POM.

The Edgetek PKE series includes short glass-reinforced formulations with 10-40% short glass fibre. These materials provide good chemical resistance and dimensional stability, low moisture uptake, and high impact and wear resistance. The reinforced grades are targeted at applications in the industrial, electronics and transportation markets like electrical battery components and under-the-hood components in contact with fuel or chemicals.

Lanxess has developed the Pocan XHR (Xtreme Hydrolysis-Resistant) range of PBT materials offering good resistance to hydrolytic degradation in hot and humid conditions. In internal testing with standardised test specimens based on the stringent SAE/USCAR2 Rev. 6 long-term hydrolysis tests of the US Society of Automotive Engineers (SAE), the compounds reached Class 4 or Class 5 – the top two ratings.

The company adds that many electrical and electronic devices are exposed to ever-higher thermal loads for reasons including confined installation spaces or elevated operating temperatures. When used in dry environments, the plastics for these devices need to be able to withstand long periods in hot air. The impact strength of most product types in the Pocan XHR series remain virtually unchanged even after 3,000 hours of being stored in air at 150°C. This makes the compounds ideal for parts in engine compartments, such as connectors, or for power electronics components.

The compounds are also ideal for overmoulding of metal parts, says Lanxess. Rapid and extreme changes in temperature often cause stress cracks in components with overmoulded metal areas because of the differences between metal and plastic in terms

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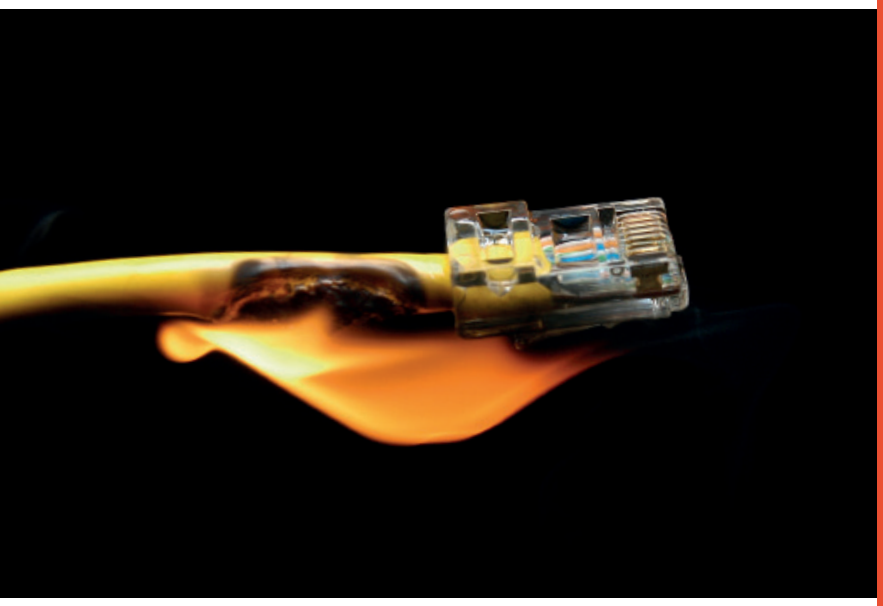

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of thermal expansion. The Pocan XHR series has an elongation at break of up to 4.7% (ISO 527-1,-2), which counteracts the formation of stress cracks. Moreover, the improved long-term temperature stability and hydrolysis resistance reduce susceptibility to stress cracks. Stress crack resistance is tested under extremely harsh conditions in heat shock tests. This involves subjecting the overmoulded components to abrupt changes in temperature from -40°C to 125°C and back in several hundred cycles and keeping them at the various temperatures for extended periods (30 minutes). Lanxess says in heat shock tests, components with Pocan XHR metal overmoulding exhibit no stress cracks or, if they do, the cracks do not appear until after many multiples of the usual number of test cycles. That makes the XHR products well suited to overmoulding metal parts, such as bus bars, connectors, power strips and main supporting frames.

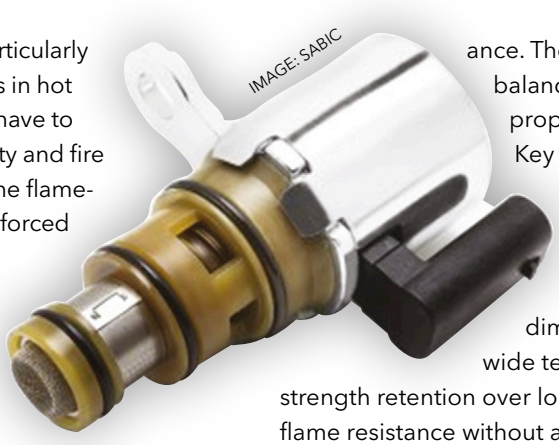
IMAGE: LANXESS

Left: One of the potential applications of Pocan XHR from Lanxess is housings for automatic parking brakes

The melt viscosity of all Pocan XHR variants remains constant for a long time at the injection moulding temperatures customary for PBT. The materials can therefore be injection moulded stably within a wide processing window. The improved flowability relative to comparable standard PBT materials makes it possible to implement thin-walled geometries. Furthermore, overmoulding of metal parts can take place at lower filling pressures, which means that the metal inserts are not distorted or pushed out of position in the tool by the molten material.

Pocan XHR also offers good resistance to strong alkalis. This reduces elongation at break by around only 40% when the material is stored at 55°C in 1-molar sodium hydroxide solution for 100 hours. This is a significant improvement over standard PBT. On vehicle underbodies in particular, a combination of road salt, cast iron, and moisture can cause a mildly alkaline environment to build up. Lanxess says that XHR compounds are therefore ideal for electrical and electronic components such as sensors, housings and connectors.

The company is also introducing flame-retardant



Right: Husco variable oil pump control technologies made from SABIC's Ultem resin

XHR compounds. They are particularly well suited to live components in hot and humid conditions, which have to exhibit good hydrolysis stability and fire resistance at the same time. The flame-retardant compounds are reinforced with glass fibres at 15, 25, and 30wt%, and are also available in unreinforced versions. All materials are equipped with a halogenated FR package and achieve the top classification of V-0 with low specimen thicknesses, according to UL 94 flammability tests. The classification is required for many plastic components in batteries of electric and hybrid vehicles, for example.

SABIC is collaborating with component supplier Husco to develop next generation automotive applications for Ultem polyetherimide (PEI) resins. Husco has been using unfilled and glass-reinforced grades for 12 years and is now looking to find new solutions for drivetrain and braking systems in future vehicles. Typical applications currently include components for electro-hydraulic control valves in variable valve timing (VVT), variable displacement oil pump control (VDOP) and cylinder de-activation control (CDA), all of which enhance fuel efficiency and vehicle performance. Cam phasing and VVT technologies are low-cost and lightweight and enable engines to maximise performance for specific loads and speeds. VDOP technologies improve efficiency by allowing engines to scale their oil usage in response to driving conditions. Husco has also been developing and producing solenoid valves for a wide range of cylinder deactivation applications. These valves control engine systems that turn specific cylinders on and off in order to maximise efficiency and performance.

According to SABIC, the range of Ultem PEI resins offer elevated temperature resistance, high strength and stiffness and broad chemical resistance. They provide a good balance between mechanical properties and processability. Key benefits of Ultem resins include: long-term heat resistance up to 180°C; good strength and stiffness up to 200°C; dimensional stability over a wide temperature range; strength retention over long periods; and inherent flame resistance without additives.

Husco says that it values Ultem because of its ease of use in injection moulding and the absence of any requirement for such secondary operations as annealing. Low creep is valuable in applications under virtually constant stress, and it provides freedom for designers to create complicated parts. The company says that it requires precision and micron-level dimensional stability across a broad temperature range that starts at -40°C and goes up to well over +150°C in applications like engine valve components, which need to survive sometimes as many as 700m cycles over their lifetimes and constant vibration loads. Ultem is also amorphous, which reduces impacts from process settings that may be seen with other high temperature rated semi-crystalline materials.

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Complex connection: what's new in joining technologies

*A range of joining technologies are available to meet a variety of assembly requirements for plastic components in many key industries. **Mark Holmes** looks at some recent developments*

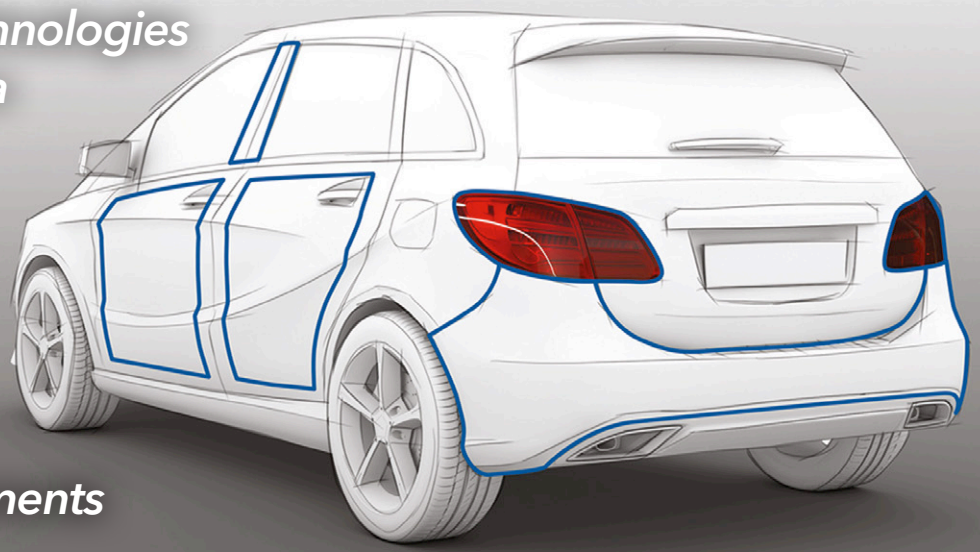

IMAGE: LPKF

Main image: Large plastic parts such as those in or on cars can be welded with laser technology

Joining and assembling semi-finished plastic materials is a well-established technique that is an invaluable tool for many applications, particularly in the automotive, electronics and medical sectors. Plastic materials can be joined using a number of different technologies including laser, spin and infrared welding, as well as hot plate, vibration and ultrasonic welding. While the techniques differ, all generate heat to melt the plastic and fuse pieces together.

Laser welding is now instrumental in the development of many high quality and innovative devices for the automotive, electronics and medical sectors, as well as many other industries. The technique can deliver reliable, dust-free, hygienic joining of plastic parts resulting in a joint as strong as the material itself.

German company **LPKF** has been developing laser welding technology for plastics for more than 20 years. In laser transmission welding, two components are welded together. LPKF explains that they differ slightly in their material properties: one of the parts is transparent to the laser wavelength used and the other absorbs the laser energy. The heat that arises locally in the absorbing part during the process is transferred through a slight mechanical pressure applied to the second part, which results in both parts melting at the weld seam – and a reliable joint with the same strength as the parent material. Many different plastics with various geometries can be welded in this way.

LPKF says that with the optimised systems it has developed the most diverse of components – large or small, with wide or narrow weld seams, exhibiting simple or complex geometries – can now be joined. There is also now extensive process automation. As a result, welded products can now even meet the exacting requirements of the automotive and medical technology industries.

"There are now over 1,200 LPKF systems for laser plastic welding in use on all continents of the world and more than 3,000 different processes are carried out with these systems," says Simon Reiser, Managing Director of LPKF. "In the automotive industry, nearly every OEM supplier is using LPKF systems. The still-growing plastics market is changing and is still searching for solutions, for example, for the further treatment of recycled plastics or new materials. LPKF is working on innovative solutions for this, too, so that the advantages of laser technology – cleanliness and joining without chemicals or chip formation – over other joining technologies can continue to be used in as many application areas as possible."

The only requirement for a successful joining process is that one of the components must be

made of a laser-transparent plastic and the other of a laser-absorbing plastic. The chart below shows materials that can be laser welded. The technology finds many applications in medical engineering, for example, for joining housings for electronic components such as insulin devices or pacemakers. In addition, cylindrical components such as catheters or pins can be laser welded precisely and reliably, as well as cartridges and microfluidics for diagnostic procedures. Individual components of plastic valves that have to withstand high pressures can also be welded well and stably with a laser. Geometric possibilities are almost limitless. The joining of two transparent parts is also possible using special radiation sources. This is particularly of interest when certification provisions for the component do not permit the addition of a laser absorber or the component must be evaluated using optical analysis methods after welding.

Recent developments at LPKF include a dual clamping device (DCD), which provides high process stability and short cycle times. Ensuring a uniform contact pressure during laser welding of plastic components is an important quality criterion. This is because the weld seam achieves optimum quality only at constant pressure across the entire welding area. In most systems, glass tools perform this task because of their laser transparency. LPKF says that the DCD offers many advantages over glass. It is an internal and external clamping system, made of metal. Due to its design with a channel for the laser beam and several specially shaped, fine holding bars that do not interfere with the weld, the DCD enables reliable, deformation-free welding seams. Even after many production cycles, consistently high-quality welding results are guaranteed, it says.

The DCD can therefore overcome the disadvantages of glass tools. Glass becomes blackened due to irradiation with the laser. Particles are bound to the material, which impair the ability of the laser beam to pass through the glass. As a result, the quality of the weld may suffer. To prevent this problem, the glass must be cleaned or replaced regularly, resulting in production interruptions. Handling is often cumbersome, and the glass can break during the cleaning process and must then be reordered and reinserted. This can affect a large production throughput.

LPKF has also developed a calibrated and certified transmission measuring device for laser plastic welding. In laser plastic welding, the light transmis-

Materials that can be laser welded

transmissive / absorbing	ABS	ASA	COC	MABS	PA 12	PA 612	PA 6	PA 66	PBT	PC	PC/ABS*	PE-HD	PE-LD	PEEK	PES	PMMA	POM	PP	PPS	PS	PSU	PTFE	SAN	TPE
ABS	++	++	×	++			×	×	++	++		×	×		+	++	+	×		×	+		++	++
ASA	++	++		×			×	×	++	+						++	×	×					++	
COC	×		+							×						+				×			×	
MABS	++	×		++			×	×	×						×		×	×			×		×	
PA 12					++	++	−	×	−			×	×		−	×	×	×						
PA 612					++	++	+	×	×							×								
PA 6					−	−	++	++	×			−	−		×	×	×	−		+				
PA 66					×	−	++	++	×	−		−	×		×	×	×	−	×	+				+
PBT	++	++		×	×	+	−	×	++	++		×	×		+	×	×	×		×	+		++	
PC	++		×					−	++	++		×	×			++		×	−	−			++	+
PC/ABS*	++	++								++	++					++								
PE-HD	×				×		−	−	×	×		++	++			−	−	×		×			×	
PE-LD	×				×		−	−	×	×		++	++			−	−	++		×			×	
PEEK														++										
PES	+	×		×		×	×	×	+						++		−	×		×	++		×	
PMMA	++			+	×	×	×	×	−	×	++	−	−		×	++	+	−		+			++	
POM	−	×		×	×	×	×	×	×			−	−		−	+	++	×		×	×		×	
PP	×	×		×	×	×	−	−	×	×			++		×	−	−	++	×		×		×	++
PPS					×	×	−	−		++					−	×	−	×	++				−	
PS	×	×	×	×			+	+	×	−					−	+	×	×		++	×		−	
PSU	+	×		×			×	×	+						++		×	×			++		×	
PTFE																						++		
SAN	++	++	×	×			×	×	−	+		×	×			++	×	×		−			++	
TPE								+		+								++		×				++

++ Excellent weld + Good weld − Poor weld × No weld No research available

*depending on the blend ratio

Data in this table can vary according to the wavelength of the laser.

SOURCE: LPKF

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sion of the plastic is decisive for the quality of the joint between two components, so a check of the material properties before welding can benefit the overall quality assurance process. The LPKF TMG 3 can measure the transmission properties of any type of plastic material prior to laser transmission welding. It takes only a few seconds to find out whether the actual transmission values of the two joining partners match the target values from the process definition. Any material non-conformities from upstream processes – compounding or injection moulding – can be detected before an unsuitable component reaches the production process. This is important because fluctuating transmittance values can result in suboptimal weld seams.

The measuring device can easily be integrated into a production line for in-line transmission testing. In this configuration, the device provides a reliable process and ensures that the weld seams and the end products meet the highest standards. The LPKF TMG 3 transmission measuring device is a certified, traceably calibrated measuring instrument. The measurement filters for the calibration were tested and certified by Fraunhofer ISC.

Cemas Elettra has developed the MF120, the smallest stand-alone machine of its simultaneous multi-fibre laser welding machine range. The machine is used to produce small components, as well as laboratory test parts, which allows the integration of electronic components in the joining process through the precision and cleanliness of laser technology. To satisfy the most stringent and complex requirements, the Cemas laser system has been designed with a fully modular architecture. The different Cemas laser machine models – MF120, MF240, MF480 and MF960 – are designed for welding small, medium or large components. The company also offers a range of vibration welding machines with hybrid technology – infrared and vibration. The machines can weld simple and small components to the most complex and large, offering good joints in terms of aesthetics and strength.

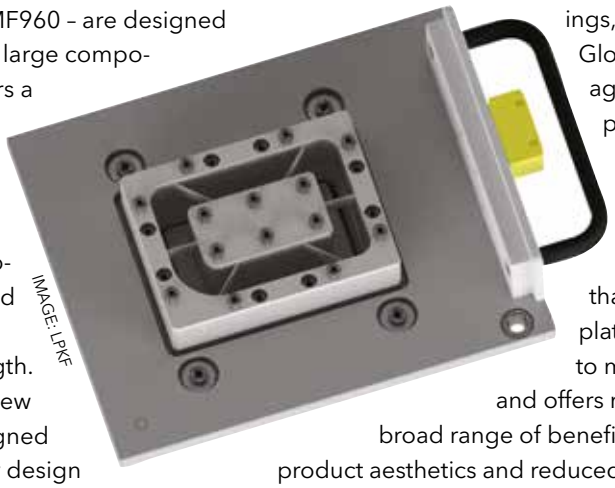

IMAGE: LPKF

Emerson has introduced new heat staking technology designed to give manufacturers greater design freedom by enabling them to join more complex, delicate and sensitive components to plastic mouldings. Using pulse staking technology that optimises the heat staking process, the company says that the Branson GPX platform produces high-quality joins, good product aesthetics and energy savings in increasingly challenging applications.

Electronics, automotive and medical device manufacturers must produce more creative designs to meet rapidly changing market demand. This has led to an increase in challenging heat staking applications involving parts with more complex 3D geometries, closely aligned features and fragile or heat-sensitive components, such as soldered components or sensors, and using a greater number of blended, glass-reinforced, chromed and metalised plastics.

Emerson adds that the Branson GPX platform uses PulseStaker technology to provide instantaneous heating and cooling, with adjustable cycle times for optimised, low energy heat staking. The process creates no particulates or burn marks, and enables more delicate and sensitive parts, such as those with embedded electronics, to be joined with consistently high-performance finishes.

IMAGE: LPKF

Above: The LPKF InlineWeld 6200 welding system is designed for integration into 24/7 production lines

The technology is suitable for all heat staking applications, including those with thermoplastic materials and metalised coated parts. A wide range of heat staking tip designs, which can be adapted to meet any stake welding requirement, and the ability to stake multiple points simultaneously provide manufacturers with greater design freedom.

"The automotive, electronics and medical industries require more complex, delicate and sensitive components to be joined to plastic mouldings," says Priyank Kishor, Global Product Manager for Branson products at Emerson's Automation Solutions business. "The unique heat staking process that the Branson GPX platform provides helps to meet this demand and offers manufacturers a broad range of benefits, such as superior product aesthetics and reduced energy use."

Left: The LPKF dual clamping device is easy to install. The design with the fine but robust retaining bars can remain in place for thousands of application cycles, says the company

Emerson has also developed a new laser welder platform that provides low volume, high mix manufacturers of plastic components with greater production capability, without compromising product quality or performance. The company says that the Branson GL-300 is a highly flexible quasi-

IMAGE: EMERSON

Right: The Branson GPX platform, with its heat-staking technology, provides greater design freedom by enabling high-quality joins and good aesthetics in a range of challenging applications

simultaneous plastic joining solution, designed to deliver efficient high-quality welds in a wide range of applications and help manufacturers to increase production efficiency.

Manufacturers increasingly need machines and processes that can be quickly and cost-effectively adapted to changing production demands and specifications. For low volume, high mix manufacturers especially, flexible welding solutions that allow faster production start-up provide a critical advantage. The Branson GL platform meets this need by combining highly efficient and accurate welds with cost-effective and easy-to-change tooling that enables faster set-up and adjustment for changing product specifications.

Manufacturing capability is further enhanced by a range of features including a high-quality scanning system, easy-to-use HMI, large (300 × 300 mm) weld area, multiple weld modes, variable spot size as low as 0.5 mm and an adjustable laser power source height. These enable the Branson GL-300 to support applications with different materials, application sizes and production speeds.

"For batch manufacturers looking for more efficient production processes, quasi-simultaneous laser welders provide a very flexible, cost-effective joining solution," says Kishor. "The Branson GL-300 extends this flexibility by enabling the assembly of a broader range of components, helping to increase manufacturing capability and profitability."

Spin welder

Forward Technology has developed a new dual-axis servo spin welder designed for a wide range of injection moulded applications requiring high rotational power and the highest degree of vertical and rotational precision. The HD2X-OSW servo spin welder provides good rotational and vertical positioning, along with a 24 inch (61 cm) stroke-weld height range. This large range allows for simple push-button recipe changes when switching from tall to short tools, or vice versa, without manually adjusting the head's vertical position. The spin welder orients part halves relative to each other with rotational tolerance accuracy of ± 0.1 degrees and provides a finished vertical weld tolerance of ±0.002 inches (0.013 cm).

IMAGE: EMERSON

Right: The Branson GL-300 is a highly flexible quasi-simultaneous plastic joining solution, designed to deliver efficient high-quality welds in a wide range of applications

The company adds that 600 lbs (272 kg) of press force gives process engineers plenty of head room when designing spin weld applications, including those with difficult-to-weld materials and large diameters. "The new HD2X-OSW spin welder combines precision and versatility, thus making it suitable for large and small applications alike," says Brett Raisanen, General Manager.

The HD2X-OSW has an upgraded Allen-Bradley package with robust controls and a range of opportunities for customisation and automation, along with statistical process control (SPC) options and other networking advantages.

According to Forward Technology, when compared to other orienting or non-orienting models, the dual-servo system allows precise control of welding depth – collapse or absolute distance – and enables synchronisation of vertical and rotational movement to optimise the weld process. The full servo control also allows for setting a recipe adjustable load position, reducing the stroke during each cycle and saving cycle time.

The company has also enhanced its linear vibration welder for a range of large injection moulded parts. The DLVW-4848-LX vibration welder has been upgraded with an enhanced drive for additional analytical options. The unit uses synchronised heads to provide substantial amounts of weld force and is capable of welding parts up to 48 × 48 inches (1.22 × 1.22 m) or multiple smaller parts. The two-pole digital (servo) drive

technology improves process control while substantially increasing the available power.

Forward Technology says that the DLVW-4848-LX is particularly suited for welding of large automotive parts, such as intake manifolds, instrument panels, and engine covers, along with plastic pallets for the transportation and logistics industries. In the plastic pallet industry, the vibration welder is an effective alternative to hot plate systems, offering significant cycle time reductions. These large welders can easily be integrated into automated systems for further labour reduction and increased throughput.

Herrmann Ultraschall has developed two software tools – FSC and SonicCalibrate – for quality assurance in the ultrasonic welding process. To ensure the required accuracy and tightness during joining, the company says that these software tools provide support in controlling the ultrasonic system. They enable reproducibility and traceability for the manufacturing process and fine adjustment and amplitude control for demanding materials.

To achieve a reproducible welding result and a constant welding process, it must be ensured that the relevant machine parameters have the same values reproducibly. The SonicCalibrate software is used to calibrate and verify the weld depth, weld force, sonotrode speed and amplitude. The correctly set speed prevents damage to sensitive seam geometries. In addition, it influences the maximum joining speed and the displacement of the melt in the subsequent joining process. The amplitude is decisive for the introduction of the ultrasonic power into the component and is therefore dominant in melt formation and the joining process. This is particularly important for sophisticated medical parts.

The FSC software offers the functionality to comply with the strict regulations of the US FDA (21 CFR Part 11) for tracking, as often required in the food, pharmaceutical and medical industries. It includes user administration and authentication as well as control of user authorisations. In addition, changes to the system are recorded in an audit trail. Herrmann Engineering provides encompassing support for welding process development: weldability tests, sample parts, seam design, technical implementation, TCO analysis, prototype tools and training.

Rinco Ultrasonics has achieved ISO 14644-1 class 6 certification for its Standard 3000 ultrasonic welding machine and has been officially approved for use in cleanrooms. Testing was carried out by CAS Clean-Air-Service AG and the Standard 3000 has also satisfied all requirements regarding maximum permitted particle concentration. The cover panel on the Standard 3000 press and the generator housing are made from stainless steel, a high-quality, hygienic material that is particularly resistant to damage from cleaning agents, making it a good choice for cleanrooms. The company adds that the certification to ISO 14644-1 provides customers with the assurance that the Standard 3000 can be used in ISO class 6 cleanrooms. The generator can be connected to an exhaust air system via the air vents. This makes the Standard 3000 well suited to all welding tasks in cleanrooms.

IMAGE: HERRMANN ULTRASCHALL

Above: Herrmann Ultraschall has developed two software tools, FSC and SonicCalibrate, for quality assurance in the ultrasonic welding process, which has many medical technology applications

Weldable materials

Lanxess has supplied PA 6 to provide a cost-effective monolayer solution for a double-shell, welded motorcycle fuel tank. Materials for motorcycle tanks need to meet stringent requirements. The company says that this means, for example, that only small amounts of fuel should be able to diffuse through the tank walls. The materials need to demonstrate a high level of tenacity and ductility, particularly in the event of a crash, offer high design flexibility for complex tank geometries, and should be cost-effective to process.

BMW Motorrad's models F 900 R and F 900 XR have been able to meet all of these requirements using a single material. The tanks in both machines are made from Durethan BC550Z 900116 DUSXBL. The unreinforced and impact-modified PA 6 is injection moulded into two half-shells, which are then welded to form a tank by means of hot plate welding. The tanks are a joint development of BMW Motorrad and Röchling Automotive Italia in collaboration with Lanxess.

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requirements of the US Environmental Protection Agency (EPA) with regard to permeation. Since it is very easy to process in injection moulding, even complex geometries can be produced cost-efficiently. And when it comes to impact loading, this extremely tough material really shows its strengths," says Dr. Klaus Küsters, Business Development Manager Blow Molding in the High Performance Materials (HPM) business unit of Lanxess.

IMAGE: LANXESS

Left: Lanxess has supplied PA6 to provide a cost-effective monolayer solution for a double-shell, welded motorcycle fuel tank

According to Lanxess, the monolayer solution with PA 6 has several advantages over previously used tank materials. The design flexibility and the integration potential of this material are significantly higher in comparison to metals, such as sheet steel and aluminium. There is also no need for costly forming, stamping, and joining steps. Corrosion is also not a factor when polymers are used. Durethan BC550Z 900116 DUSXBL has significantly lower fuel permeation compared to other polymers, such as high-density polyethylene (HDPE). Although fluorination can further reduce permeation in HDPE tanks, it is advantageous to avoid this additional manufacturing step due to the costs involved and the chemically aggressive fluorine. The monolayer solution with PA 6 is significantly less expensive than multi-layer systems that contain a highly polar layer, usually made of ethylene vinyl alcohol copolymers, as a permeation barrier. If the wall thickness is designed accordingly, the permeation values of the monolayer solution are several times lower than the limit of 1.5 g/m² of inner surface per day as required by the EPA in EPA 40 CFR.

Durethan BC550Z 900116 DUSXBL was originally developed for the blow moulding process and has been used in the series production of blow moulded fuel tanks for several years. Due to the increasing number of functions in motorcycles – for example, ASC (automatic stability control) – the installation space for fuel tanks is becoming increasingly fragmented and complex. These geometries are no longer suitable for the blow moulding process. For this reason, for the current BMW Motorrad tanks, two halves are injection-moulded and then welded to form the tank.

"With the injection moulding process, it is not only possible to produce more complex geometries, but the wall thickness distribution can also be precisely controlled, which in turn facilitates a more precise tank design using CAE tools," says Küsters. The welding properties of PA 6 are essential for reliable tank production. "This material is characterised by its excellent welding abilities. Our customers have a wide process window at their disposal to reproducibly create tight weld seams. A weld seam factor of 1 can be achieved easily," says Frank Krause, expert in plastic welding at Lanxess.

Another special feature of this material solution is its high impact resistance. This means that the fuel bladder remains intact and no fuel escapes even in the event of a crash. Pendulum impact tests on aged tanks, for example, do not result in leaks at -20°C or at 60°C. Due to its property profile, Durethan BC550Z 900116 DUSXBL is also suitable for tanks for small vehicles, such as quad bikes, snowmobiles, and ride-on mowers, and for gasoline-powered garden tools, such as chainsaws and leaf blowers.

Avient has developed a Bergamid laser weldable material for use in automotive parts, consumer goods and medical devices. With well-controlled laser transmission rates, multiple colour choices and customised performance options, this addition to the Bergamid portfolio allows manufacturers to produce high-performance parts with durable welds and smooth surfaces.

The company says that polymers used for laser welding must allow a minimum 20% transmission rate for laser energy. In addition, laser absorption can be controlled by adjusting the type of pigments. A range of off-the-shelf and tailor-made solutions is offered to meet the required laser transmission rates for applications in a variety of markets. Commercially available in Asia only, the material solutions are formulated in PA 66 with proven laser weldability.

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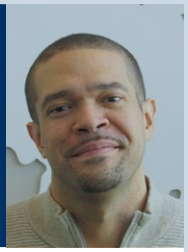

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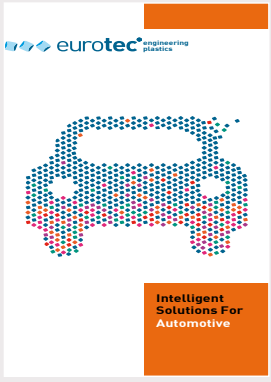

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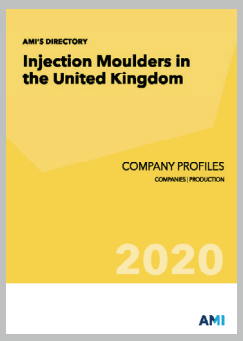

A complete and up-to-date picture of the injection moulding industry in the United Kingdom. Find out the polymers processed, the products manufactured and the number and size of machines operated by 904 injection moulding sites in the United Kingdom.

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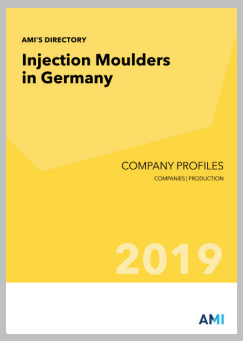

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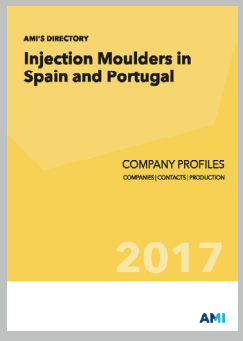

A unique insight into the production of 1011 injection moulders in the Iberian peninsula. This directory gives you access to managerial contacts and production information on 790 manufacturing sites in Spain and 221 in Portugal serving a number of markets such as medical, automotive, electronics as well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

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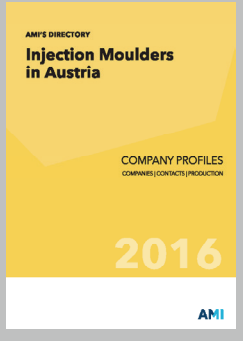
Injection Moulders in Austria



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 pdf 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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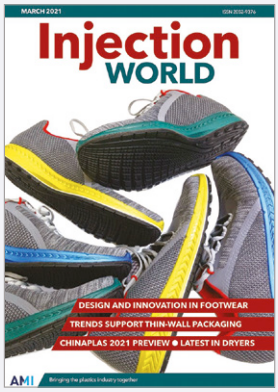

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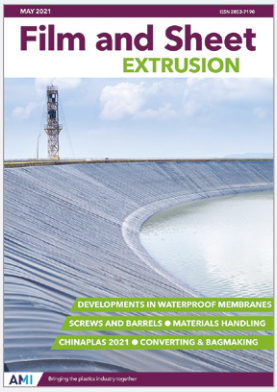

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