The Eternal Circle

Circular Economy and Digitalization Are Key Issues for Machine Manufacturers

It is not new to state that injection molding is a cyclic process. However, injection molding manufacturers are now concentrating on another cycle. Machine concepts for processing bioplastics or recyclates are being optimized, the energy efficiency of machines increased, and rejects minimized in order to contribute to the circular economy.

The manufacturers are using optimized plasticating units and adaptive process control systems, to show that the strong viscosity fluctuations occurring during the processing of recyclate can be kept in control and many applications can also be implemented with bioplastics as part of a circular economy. Besides the circular economy, there are also other issues shaping plastics processing. The strategic change to e-mobility, as well as new regulations on medical products and packaging are posing new challenges to the machine manufacturers.

Many machine makers are addressing the field of medical technology with machine designs adapted to cleanroom conditions. New technical developments can be found in special injection molding processes, such as multicomponent or micro injection molding – the latter also has a large number of applications in the field of liquid silicone rubber. Moreover, the manufacturers are rigorously pursuing the road to the "smart factory", with increasing networking between the machine and ancillary equipment as well as the cross-process acquisition and analysis of data.

The Author

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Billion

New Vertical

Billion S.A.S., Bellignat, France, 70 years after it was founded, is introducing the new generation of the Select² high-speed electrical series, which is available in a clamping force range between 1750 and 4000 kN. The trend toward the circular economy is motivating Billion to demonstrate a sandwich injection molding process with this machine series. Recyclate can be used as a core material without being visible in the end product, as is demonstrated by Billion in collaboration with FM Kunststoff Technik, with the manufacture of a coffee cup. The Easycontrol assistance system measures the material viscosity in real time and eliminates batch deviations in the material in order to increase the process stability and reduce rejects.

With the Vertis series, Billion is presenting a new vertical machine with a round table (**Fig. 1**), using it to demonstrate the production of a multifunction mold. The tiebarless machine with C-frame offers a simple accessibility for handling systems and is therefore suitable, e.g., for overmolding inserts.

Using the example of the Vertis series, the French machine manufacturer is also presenting its activities in the field of Industry 4.0, using the Euromap 63 communication protocol. Its partner Sise SAS provides the data exchange and acquisition systems, which store the process parameters on a client server assigned to parts. The process parameters can be called up for each part via a QR code.

↘ **Hall 15, booth B24**

Fig. 1. According to the manufacturer, the Vertis hybrid vertical machine offers impressively high precision and speed, with low energy consumption (© Billion)

Arburg

Plunge into Digital and Eco-Efficient Production

With a total of 20 injection molding exhibits, nine at its own booth, Arburg GmbH + Co. KG, Lossburg, Germany, is demonstrating not only familiar special processes, such as in-mold labeling (IML), multicomponent injection molding and thermoplastic foam injection molding. A large area is also devoted to the processing of special materials, including highly filled magnetic plastics, bioplastics and recyclates.

In addition, there is a focus on customer service, which Arburg has expanded with the "arburgXworld" customer portal. Apps are available for unlocking the various service and monitoring functions for specific customers (**Fig. 2**). Besides free functions, such as the "Machine Center," "Service Center," "Shop," and "Calendar" apps, there will also be paid features with considerable added value available as from K 2019. For example, "Self Service," the "Dashboard" for the machine status, the control simulation, collection of process data and machine layout are new features. In addition, the customer portal is available in 18 languages as from the trade show.

Arburg is concentrating its circular economy activities in the "arburgGreenworld" program. At the fair, the machine manufacturer will show two applications. First, an Allrounder 1020 H hybrid injection molding machines manufactures beakers from polypropylene containing 30 % recyclate, in an eight-cavity mold. A second system processes a post-consumer recyclate from household waste to manufacture a technically challenging door handle by thermoplastic foam injection molding. The two-part handle is assembled directly in the mold before being overmolded by a soft TPE component.

Another focus is on the "smart" machine, which monitors its processes and actively supports its operator. An example of this is the filling assistant developed together with Simcon kunststofftechnische Software GmbH, which animates the degree of filling of the part in relation to the current screw position on the machine user interface as a 3D graphic. In this way, the user can achieve a comparison of the part filling over multiple cycles. The basis for this is a simulation model which has been created in advance and is read into the machine control system. At the trade show, Arburg presents the assistant on an Allrounder 570 A type machine with 2000 kN clamping force, which produces eye glasses from PA12 in a cycle time of 45 s.

Fig. 2. The "arburgXworld" customer portal, which has been available since March 2019 offers app-based services and monitoring functions (© Arburg)

Arburg demonstrates the back-molding of films with integrated electronic functions by the IML process on an all-electric machine (Allrounder 470 A) with 1000 kN clamping force with the manufacture of a night light. An Allrounder 270 A is running a micro injection molding application with liquid silicone rubber (LSR). Equipped with a micro injection unit, the machine produces microswitches in an 8-cavity mold with a part weight of 9 mg, in a cycle time of approx. 20 s.

↘ **Hall 13, booth A13**

Dr. Boy

Fitness Program for Hydraulics

With a total of 18 exhibits, eleven of them at its own booth, Dr. Boy GmbH & Co. KG, Neustadt-Fernthal, Germany, is presenting almost its complete machine portfolio, as well as an alternative (space-saving) option for positioning its successfully introduced LR 5 linear handling unit on an injection molding machine. At the biggest booth in the company's history, the machine manufacturer points out its core competences in insert molding, micro injection molding, as well as the processing of elastomers and silicones. Another focus will be sustainability. In five applications, bio-based and recycled materials are processed on Boy automated injection molding systems.

It will be additionally showing solutions for increasing the digitalization of production and increasing the degree of automation. The possibilities for networking injection molding machines and ancillary equipment are also to be demonstrated with reference to a hard/soft application on an automated manufacturing cell. At the end of the cycle, the trade fair visitors can interact with a collaborating robot. However, the production data of the two-component part can be tracked at any time.

And another announcement: from fall 2019, Boy will deliver its automated injection molding systems ex-works with viscosity-optimized high-performance hydraulic fluid. With the name EconFluid (**Fig. 3**), the hydraulic fluid is reported to offer considerable savings potential in the energy consumption of the injection molding machines. The power consumption of a Boy 35 E in a sample cycle is thus reported to have been reduced from 1950 to 1765 W. In operation, the fluid scores thanks to better easy running properties and a significantly lower oil temperature, which significantly reduces the additional energy demand for oil cooling. After the servoelectric pump drive, which Boy integrated into a machine as early as 2008, and the development of the energy-economical plastication technology EconPlast 2013, EconFluid is another step toward energy saving.

Fig. 3. In long-term tests, EconFluid, a hydraulic fluid with optimized viscosity, significantly reduced the energy consumption of the injection molding machines (© Dr. Boy)

↘ **Hall 13, booth A43**

Engel

More Digital Helpers

Engel Austria GmbH, Schwertberg, Austria, operates system solutions for networking production systems and utilizing machine, process and production data for the use of intelligent assistant systems. To compensate for the large batch fluctuations in the processing of recyclate, Engel makes use of the already established "iQ weight control" system. Even with a change of the recyclate, which is used to simulate severe batch fluctuations at the trade show, this system ensures complete part filling.

However, the main focus is on the two new assistance systems "iQ process observer" and "iQ melt control." With the first, the software continually analyzes several hundred process parameters, thus permitting process monitoring that includes all the relevant injection molding phases – plastication, injection, cooling and demolding (**Fig. 4**). By continually comparing various process parameters inline, with defined reference parameters, the software identifies trends extending over multiple cycles. The system shows the machine operator the causes of unfavorable process settings and states and thereby supports him with process optimization.

The "iQ melt control," on the other hand, addresses the plastication phase. From the screw type and the material to be processed, the system determines the optimum metering parameters (metering time, backpressure and temperatures). It is intended to obtain good melt homogeneity on the one hand and, on the other hand, to reduce the wear of the mechanical components of the plasticating unit. The two systems are demonstrated together with established assistance systems, processing fully recycled ABS on a victory 120 machine.

In the processing of recyclate, comparatively poor part surfaces often represent a disadvantage. In order to achieve a high recyclate content despite this, sandwich injection molding is used. Here, the recyclate is only used as a core material. With its Skinmelt process, Engel is showing a compact solution based on a twin-platen duo 3660H/1560W/450 injection molding machine. The second plasticating unit for the thin skin layer is mounted in an acutely angled configuration above the horizontal injection unit for the core material.

To meet contradictory requirements on the mechanical properties and the weight, it is state

Fig. 4. The "iQ process observer" is a smart assistance system for continuous monitoring of several hundred injection molding parameters over multiple phases (© Engel)

Fig. 5. The selection of organic sheet according to load requirements allows the individual part regions to be specifically taken into account (© Brose)

of the art to reinforce thermoplastic injection molded parts with fiber-reinforced semi-finished products. Reinforcement can be carried out, for example, by back molding organic sheet with a thermoplastic matrix. A heating step is necessary first, before the organic sheet is inserted into the injection mold, where it can be back molded. With a manufacturing cell and the so-called Organomelt process, Engel is presenting a technical and logistic solution for fully automatically processing three organic sheets with different geometries and wall thicknesses between 0.6 and 2.5 mm to form a complex composite component (**Fig. 5**), taking into account different preheating times during the process sequence.

In the field of film back-molding, the focus is on complex geometries and production of large numbers of variants. A victory 1060/300 injection-molding machine with integrated viper 20 linear robot was used by Engel to demonstrate the high flexibility in the roll-to-roll IMD process, using a complex sample part. The process allows both multilayer film systems with a painted surface and structured, backlit films functionalized with capacitive electronics. To exchange the decor, structure and functionality, it is necessary to change only the roll, not the mold.

Hall 15, booth C58

Windsor

Flexibility in Multicomponent Injection Molding

Windsor Kunststofftechnologie GmbH, Hanau, Germany, has marketed servohydraulic injection molding machines from the Fu Chun Shin (FCS) Group of Taiwan, with clamping forces between 300 and 37,000 kN, in Europe since 2016. The FCS FA-160 servohydraulic toggle machine with 1600 kN clamping force is celebrating its premiere in Europe (**Fig. 6**). In general, FCS has strengthened the stationary platen of the FA series and optimized the clamping force profile, leading to longer mold lifetimes, according to the manufacturer. A production management system monitors, optimizes and logs the product and process data.

Fig. 6. The servohydraulic FCS FA-160 injection-molding machine produces lunch boxes of PP at the K trade fair (© Windsor)

With the PlugXPress series, Windsor is additionally presenting an additional plasticating unit with three-zone screw, which can be flexibly connected to a conventional machine for manufacturing multicomponent parts. The unit has its own control system and communicates with the injection molding machine via an interface.

Hall 12, booth B11

Windsor additionally represents the German sales and service of the Japanese machine maker Japan Steel Works Ltd. for injection molding machines. Two all-electric injection molding machines demonstrate the "Sofit" foaming process in a multicomponent application as well as the processing of biodegradable plastics.

Hall 13, booth B45

Sumitomo (SHI) Demag

Smart, Fast and Sustainable

Sumitomo (SHI) Demag Plastics Machinery GmbH, Schwaig, Germany, considers the circular economy and efficiency as future themes of plastics processing. In addition, digitalization continues to be a focus. A networked cell with remote-diagnosis options, online support, document tracking and spare parts ordering are representative of the "smart services" offered by the machine manufacturer. Visitors can use networked terminals to see how the "myConnect" software improves customer service.

For the packaging sector, Sumitomo (SHI) Demag presents a large and a small version of energy-optimized El-Exis SP high-speed machines. Compared to their predecessors, they are characterized by up to 20% lower energy consumption. To keep packaging as thin-walled as possible and the cycle times as short as possible, the hydraulic accumulator is designed for injection velocities up to 1000 mm/s. At the trade show, with a 72-cavity mold, 130,000 caps for water bottles are produced per hour.

The machine manufacturer presents the new IntElect series with the manufacture of a touch decorative film for a vehicle console by the IMD process. The machines, available in the clamping force range up to 5000 kN, are characterized by a large tie-bar spacing combined with large opening strokes so that they can receive large molds. A less energy-intensive machine is thus available for automotive applications that previously would have required higher clamping force models.

In the field of health technology, the product portfolio is targeted at manufacturers of large-series parts. The new IntElect machine is designed for precise high-speed applications with cycle times between 3 and 10 s, and is presented with the manufacture of pipette tips in a 64-cavity mold. The mold mounting space was designed to reduce the risk of contamination of the manufactured parts, e.g. by lubricants. Improvements to high-performance drives additionally prolong the machines' lifetime, according to the manufacturer.

For multicomponent injection molding, the German-Japanese company is presenting an inexpensive expansion solution (**Fig. 7**). The eMultiPlug can be flexibly flange-mounted vertically or laterally on an existing machine, depending on production requirements, thereby extending it with an additional plasticating unit.

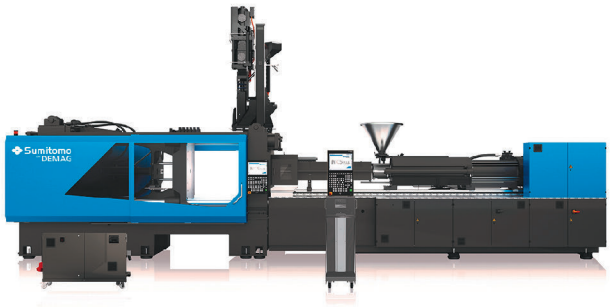

Fig. 7. The eMultiPlug (shown here as the vertical model) offers an easy way of retrofitting machines for multicomponent technology
(© Sumitomo (SHI) Demag)

Hall 15, booth D22

Wittmann Battenfeld

Machines with Adaptive Algorithms

Adaptive assistance systems intervene in the process and are thus capable of evening out viscosity fluctuations and stabilizing the process. This is shown by Wittmann Battenfeld GmbH, Kottingbrunn, Austria, with its "HiQ Flow" system using the example of the manufacturing of clothespins from polycarbonate on a type EcoPower 55/350 machine. Batch fluctuations were additionally introduced into the process in the form of regranulated sprues and deliberately manufactured reject parts. Furthermore, the networked production cell features a digital mold data sheet. This helps the machine operator to estimate whether the connected ancillary equipment, networked by means of a Wittmann 4.0 router, is suitable for the preselected product data record, or further equipment might be necessary.

Health applications are covered by three exhibits. An EcoPower Xpress 160/1100+ servohydraulic machine manufactures blood tubes from PET in a 48-cavity mold. This series is available for the first time in a medical version. For the illustrated application case, the machine is equipped with a special PET screw, and has a frequency-controlled Drymax 300 type dryer, which is integrated into the material hopper.

Another medical application presents the manufacture of extremely small parts in the cleanroom, with the example of a holding ring for medical tubes. The rings weighing 2 mg are produced on a MicroPower 15/10 micro injection molding machine with rotary plate in a mold with eight cavities. The two-stage screw-piston unit has recently been enhanced such that it can now process shot volumes up to 6 cm^3. The manufacturing cell is complemented by a camera system, which permits separate sorting according to cavities.

The third exhibit from the field of health technology demonstrates the processing of liquid silicone rubber. An EcoPower 160/350 all-electric machine manufactures valves with a 16-cavity mold. An engineering feature here can be found in the plastication unit with an open design, which allows easy integration of the LSR metering system.

Wittmann Battenfeld addresses the question of lightweight construction with the Cellmould in-house-developed physical foaming process (**Fig. 8**). As blowing agent, nitrogen is collected from the ambient air and compressed to the operating pressure of up to 330 bar in a pressurization unit. The process is used to manufacture a bench seat carrier for a sports car. A MacroPower 1100/12800 machine is used for this. It features a condition monitoring system (CMS), which permits continuous state monitoring of the most important machine parameters. The polypropylene used consists of 25 % post-consumer recyclate and talc.

In a second automotive application, a module for a car headliner is manufactured using the IMD varioform process developed by Leonhard Kurz. A translucent decorative film is combined with a functional film with printed sensor structure on the inside of the molding. A handling system first places the functional film in the mold. In the roll-to-roll process, a further film, preheated by an IR emitter, is positioned over it and vacuum thermoformed. The two films are back-molded in one step.

Fig. 8. The nitrogen for foam injection molding was collected from the ambient air (© Wittmann Battenfeld)

The processing of bioplastics is also shown by Wittmann-Battenfeld. In a family mold, four cosmetic jars and lids are injection molded simultaneously. The natural material developed especially for the purpose can be recycled without loss of properties. For the manufacture of the lids, a second plasticating unit in L-configuration is used. The assembly steps and the labeling of the jar base via in-mold labeling are also integrated into the manufacturing cell.

↘ **Hall 15, booth C06**

Husky

Injection Molding Packaging Flawlessly

As an expert for production lines for plastic packaging, Husky Injection Molding Systems Ltd. Bolton, Ontario/Canada, is focusing its presentation on the digitalization of flexible production and sustainable processes and products. The injection molding solutions shown in Düsseldorf, Germany, stress the wide range of plastic packaging for foods, alongside applications for health care, automotive and the cosmetics industry.

The Canadian company is unveiling the new HyPET HPP5e system for manufacturing PET preforms (**Fig. 9**). According to the manufacturer, it is characterized by low energy consumption and high system reliability and user friendliness. Compared to its predecessor, smart real-time control functions represent a considerable enhancement. These facilitate operation and fault diagnosis. A new conveying technology is intended to reduce the bounce-back of the preform when it hits the conveyor belt, thereby ensuring gentle demolding. In this way, Husky promises higher preform quality as well as fewer rejects and cycle interruptions. The company has also announced a mold for flexible and smaller production batches under the name "NexPET".

Fig. 9. The new HyPET HPP5e system permits the production of preforms with fewer rejects (© Husky)

↘ **Hall 13, booth A61**

KraussMaffei

Product Family Completely United

KraussMaffei Technologies GmbH, Munich, Germany, is concentrating on the topic of digitalization. Its focus is on the question of how production that has grown organically, with older legacy machinery from different manufacturers, can be integrated into a networked manufacturing environment. A digital retrofit allows older machines to be upgraded. Depending on the available IT structure, they can thereby save process data via a gateway PC in the cloud or close to the network by means of an edge PC. The advantages: for customers, according to KraussMaffei, are quality improvement, production control as well as higher efficiency due to the reduction of maintenance, energy, material and personnel costs. To elucidate the injection molding process in its entirety, KraussMaffei has, for example, the preconfigured DataXplorer data storage (**Fig. 10**), which can process up to 500 different measured values per second. The system not only acquires machine data, such as the screw path or cylinder temperatures, but also data from different ancillary equipment or from pre- or post-processing steps.

For process monitoring across different manufacturers, the Munich team has developed the "Social Production" app solution. The machine operator is provided with alarm and threshold values, which help to identify faults at an early stage while choosing condition-based maintenance intervals. The name is taken from an (industrial) messenger system contained in the system, which is intended to simplify communication in production by replacing private messenger systems. The complete integration of the Netstal machine series into the KraussMaffei family is entirely new. The customer advantages result especially from a standardization of the sales organization. In addition, KraussMaffei hopes to unleash stronger synergies in the field of packaging and health technologies. Two examples of packaging applications can be seen live at the trade fair booth. A GX series machine, which was presented for the first time with a clamping force of 11,000 kN, produces buckets with 20 l capacity (shot weight: 1.5 kg) in two cavities in about 14 s. The HPS (high-performance screw) barrier screw for polyolefins, due to the large L/D ratio of 26 permits a particularly rapid melting and high shot weights. The neighboring machine of the Netstal Elios line manufactures six thin-wall cups in parallel in 3.5 s. Both products are labeled by the IML (in-mold labeling) process.

Fig. 10. The DataXplorer can be used for monitoring not only the injection molding process but also extrusion lines and reactive processes (© KraussMaffei)

In the field of health technology, with the manufacture of syringes on a Netstal Elion 800 equipped with a 16-cavity mold, the emphasis is on a high-speed application. An innovation here is the inline printing of syringe bodies of COC. Manufacturers profit from the lower logistics expenditure and the reduced risk in the process and logistics chain. In addition, an all-electric PX 25 from KraussMaffei manufactures a micro-membrane of liquid silicone rubber (LSR) weighing 0.3 g. The APC plus assistance system ensures that the shot weight is kept highly constant.

↘ **Hall 15, booth C24**

BMB

Energy-Efficient High-Speed Machines

BMB S.p.A., Brescia, Italy, specializes in particular in high-speed machines for packaging applications. The all-electric machines of the eKW series, which are now available up to a clamping force of 14,000 kN, store the energy from braking and consequently achieve high energy efficiency. At the same time, the machines are designed for very dynamic and high-precision movement sequences, such as those required for manufacturing packaging. The plasticating unit of the hybrid series can thus achieve injection velocities of up to 900 mm/s thanks to a double-acting servo valve. Compared to earlier series, BMB is increasingly pursuing the integration of sensors to meet increasing requirements on the process monitoring and reliability. A remote system additionally permits a direct connection to customer service.

The fact that the eKW series is also suitable for processing bioplastics is demonstrated by BMB with the production of coffee capsules in a 64-cavity mold (**Fig. 11**). The eKW70Pi/2200 Full Electric machine, with 7000 kN clamping force used for this has a second plasticating unit, with which a membrane is injection molded in the same mold as a barrier layer between the interior and exterior wall. However, at the heart of the machine is a special screw, which was optimized for processing compostable PP.

Fig. 11. The precision metering all-electric machine produces biodegradable coffee capsules with a micrometer-thin barrier layer (© BMB)

The processing of a PP recyclate is demonstrated for a further packaging application on an eKW1000/18500 hybrid machine with 10,000 kN clamping force. A handling unit is used to fit a handle to each of the four quadrangular buckets manufactured in the mold while still in the machine. With a combination of in-mold labeling and foam injection molding, food containers decorated on two sides and on the base are manufactured in a four-cavity mold. The process, taking 4.5 s, runs on a eKW45Pi type hybrid machine.

↘ **Hall 13, booth A33**

Haitian

The Third Technology Generation

Haitian International Holdings Ltd., Ningbo, China, sees its strengths particularly in the field of standard applications, which are dominating the world in terms of quantities. With four injection-molding exhibits, the injection molding machine manufacturer presents the third generation of its machine technology with new hardware solutions.

The highlight is the world premiere of the new injection unit for the electrical series of the Zhafir brand from the Haitian Group (**Fig. 12**). Along with four different design variants with up to four spindle drives, the new unit, according to the manufacturer, achieves high injection pressures. Furthermore, on an all-electric machine of the Venus III series with laminar flow box, Haitian is demonstrating its suitability for health applications. This machine type is additionally designed for precision and low energy consumption. The Zhafir machine portfolio is completed with a packaging application on a model of the hybrid Zheres III series. In a 4-cavity mold, the machine manufactures lids of PP, which are labeled by IML.

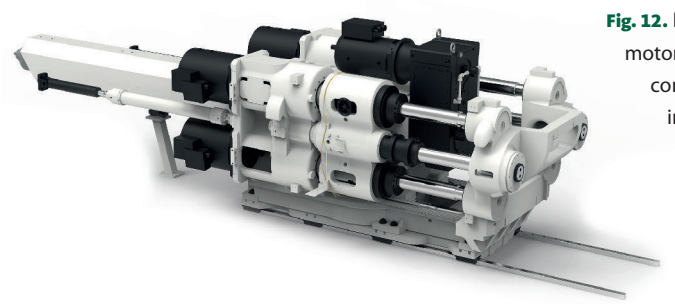

Fig. 12. Four spindles and four motors: the newly patented concept for large electric injection units (© Haitian)

With the manufacture of LED light strips of PC, integrated in a manufacturing cell with assembly and sorting, Haitian is demonstrating a Jupiter III series twin-platen machine. Design changes to the third generation result in more stable platen movements and shorter dry-running times. Haitian is also presenting the Mars III servohydraulic series, which is principally suitable for manufacturing consumer goods. Haitian's best selling machine produces bottle openers from a PP recyclate by insert technology.

↘ **Hall 15, booth A57**

Milacron

New Frontiers in Data Technology

In its trade fair concept, Milacron Holdings Corp., Cincinnati, OH/USA, is stressing the topics of digitalization, new process control concepts and resource-efficient production. The Q series represents new developments in servohydraulic toggle clamping units (**Fig. 13**). They are available in a clamping force range between 500 and 5500kN and, according to the manufacturer, are characterized by high positioning accuracy and energy efficiency. By the editorial deadline, nothing was known about the application planned for the trade fair, or for the other exhibits.

Fig. 13. The Q series is available in ten different sizes between 500 and 5500 kN (© Milacron)

The Elektron all-electric machine series is also impressive for its low energy consumption. Compared to hydraulic drives, the machine also consumes considerably less water. The series includes the new FEA-optimized clamping unit, with greaseless ejector area. Because of the high plane parallelism, coupled with the high positioning accuracy thanks to the servo motor, this machine type is especially suitable for manufacturing precision components.

The Cincinnati series expands the portfolio for the manufacture of large parts. The optimized machine specifications and performance data of this series are based on tried-and-tested Fanuc servo motor package, which, according to the manufacturer, achieves greater reliability, higher maximum part weight and faster closing velocities.

Milacron's "M-Powered" system permits extensive data analysis. Besides monitoring process data, the MES-like system can also be used for the predictive scheduling of maintenance intervals. The associated connect portal makes key information available to mobile devices in real time. The "iMFlux" module supplements the system with adaptive real-time control. In the case of high batch fluctuations, in particular, which can occur when processing recyclates, the system can help to improve efficiency and productivity while at the same time lowering energy demand.

↘ **Hall 1, booth C05**

Conclusion

The circular economy is the central topic of plastics processing this year. The machine manufacturers are playing their part in this by focusing on options for processing recyclates and bioplastics. The topic of digitalization, which was predominant in recent years, has been pushed into the shade somewhat. Nevertheless, ever more machines have assistance systems for process monitoring or adaptive process control, in order to meet increasing demands on the reproducibility and quality standards.

Plasmatreat

Hard and Dense Bond

In multicomponent injection molding or for the manufacture of hybrid components, a high bond strength is essential. If this is not present, the new in-mold plasma process from Plasmatreat GmbH, Steinhagen, Germany, can help. With the process, developed in cooperation with the University of Paderborn, Germany, the strength of two otherwise incompatible joint parts (TPU and PP) can be increased in a peel test to up to 16 N/mm. Since the plasma treatment takes place directly in the mold, multicomponent parts can be manufactured in short cycle times on a 2-component injection-molding machine. The main advantages of the process can also be found in the fact that the part quality can be increased and monitored and controlled purely via process parameters. Plasmatreat demonstrated the manufacture of a demonstrator on an Allround 570 S two-component injection-molding machine (manufacturer: Arburg).

Using the production of a double-row media-tight connector, Plasmatreat is demonstrating the so-called Plasma-SealTight process. This provides an inline solution for media-tight metal-plastic connections of injection molded parts (**Fig. 14**). No pretreatment steps or primers are necessary. In the process presented, a CuSn6 blank is first provided with bridges of PA6-GF30. After cleaning, which is also plasma-based, the plasma coating is applied to the metal component. The part is in turn overmolded with PA6-GF30 and assembled with a second identical part to form a finished connector.

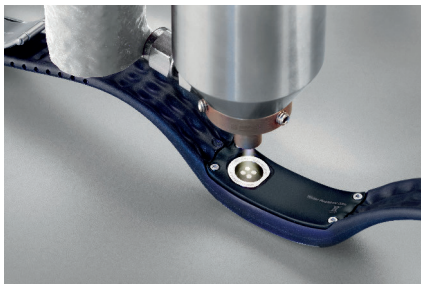

Fig. 14. The Plasma SealTight coating generates a media-tight bond, thus reliably protecting sensitive electronic parts (© Plasmatreat)

↘ **Hall 11, booth G04**

Trexel

More Flexible Foaming

Trexel GmbH, Gummersbach, Germany, is familiar as a supplier of the MuCell physical foam injection molding. Current developments are focused on the foaming of thin-walled packaging parts. In the manufacturing process, they benefit from the better flow behavior of the melt since the viscosity is reduced by the introduction of the blowing agent (nitrogen). Trexel is presenting the new P-series MuCell system at the BMB booth. Here, Trexel is also showing the Tip Dosing Module (**Fig. 15**). The module can be screwed onto a standard screw and replaces the conventional screw tip and nonreturn valve. The system can be exchanged between different machines relatively easily. According to the manufacturer, this solution shows reduced wear and can also be used without foaming according to requirements.

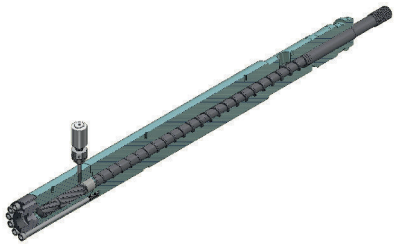

Fig. 15. With the Tip Dosing Module (TDM), a standard screw can be retrofitted for foam injection molding (© Trexel)

Trexel now also offers a solution for chemical foam injection molding in Europe under the name TecoCell. The patented chemical process is reported to greatly surpass traditional blowing agents. With the use of 0.08 µm-sized $CaCO_3$ particles, a uniform microcellular foam structure is obtained – together with high weight reduction and good mechanical properties and surfaces.

↘ **Hall 13, booth B46**

MHS

Direct Gating of Microparts

Mold Hotrunner Solutions (MHS) Inc., Georgetown, Ontario/Canada, is actually a specialist in hotrunner systems. MHS has now used this expertise to develop its own micro injection molding machine (**Fig. 16**). The innovation is that the M3 does not use a conventional injection mold but compact, inexpensive module blocks, which can each receive eight cavities. The part weight may be up 1 to 400 mg per cavity. A hot-runner system is permanently installed in the machine. In this way, the material waste can be reduced, which, particularly in the case of micro injection molding with cold runner may often be greater than the shot weight. This is particularly attractive for processing expensive high-performance plastics, such as PEEK or bioresorbable materials.

The machine with a tiebarless clamping unit and a clamping force of 40 kN is characterized by its compact design. A high-speed camera on the vertical removal unit monitors the parts and cavities after each injection molding operation. Part removal, quality control and assembly can be performed specific to cavities. It can also be used in a cleanroom.

Fig. 16. The M3 micro injection molding machine has an integrated hot runner system and (right) an integrated Vision System (© MHS)

↘ **Hall 13, booth D37**

Yizumi

Combined Injection Molding and Compounding

Yizumi Germany GmbH, Aachen, Germany, was founded in 2017 as a subsidiary and research and development center of the Chinese machine manufacturer Guangdong Yizumi Precision Machinery Co., Ltd., in order to expand and reinforce the research, supplier and customer networks. The current development themes are reflected in the exhibits.

Direct Compounding Injection Molding (DCIM) combines a compounder with an injection-molding machine (**Fig. 17**). Here, the machine manufacturer has entered a long-term cooperation with Exipnos GmbH, Merseburg, Germany, which supplies the formulations. The formulations can be monitored and modified online. Besides building complete systems, Yizumi also retrofits conventional injection-molding machines with DCIM technology independent of manufacturer. As an example, Yizumi presents the process with a 1600 kN injection molding machine of the A5 series in combination with a compounder (type: CDS 34) as well as the necessary gravimetric dosing belt weighers.

The so-called ReactPro process is another special process for technical moldings. Plastic parts are flow-coated with a polyurethane lacquer in the injection mold. Another focus is high-speed applications for the packaging industry. A trade-show machine (type: Pac 200) manufactures thin-wall packaging in a cycle time of 2.5 s. It includes an IML stage for labeling.

- **Hall 13, booth D80 (thermoplastics)**
- **Hall 14, booth D59 (elastomers)**

Fig. 17. The DCIM process allows compounding on the injection molding machine (© Yizumi)

Negri Bossi

Blow-Molded in the Injection Mold

Fig. 18. The Nova sT machines are equipped with the Motus control system, on which virtually all axis movements can be adjusted (© Negri Bossi)

Negri Bossi S.P.A., Cologno Monzese, Italy, hopes to draw the visitors' attention to the new type Nova s600T machine (**Fig. 18**). It rounds out the series, which is now available in sizes between 6000 and 13,000 kN, in the lower clamping force range. The servohydraulic machine, according to the manufacturer, characterizes the especially compact design of the toggle clamping unit. At the trade fair booth, the machine produces the individual parts for a folding box, which is automatically joined together at a connected assembly station.

Furthermore, Negri Bossi is running two all-electric machines from the Nova eT series. The series is predestined for applications from the packaging sector, health technology and the optical industry. The machines are available in a clamping force range between 500 and 3500 kN and, according to the manufacturer, are characterized by a wide tie-bar spacing and high injection velocities. A model with 1300kN clamping force, which is equipped with a 40 mm barrier screw, uses a mold from the Spanish mold manufacturer Molmasa for the production of roll-ons. According to the company, this is a patented process for producing blow-molded containers directly on the injection molding machine.

In addition, Negri Bossi is presenting its in-house developed foaming process "Foam Microcellular (FMC)," which is available for both thermoplastic materials and liquid silicone rubbers. At the trade fair, the machine manufacturer is manufacturing brushes from a sustainable wood-filled plastic compound.

- **Hall 15, booth B22**