

The Communicative Machine

Fakuma 2018: Injection Molding Networked and Integrated

The announcements in the field of injection molding give the impression that the developments of recent years are continuing. These include the increasing digitalization of injection molding production, as well as highly integrated production cells that combine very different competencies. The spotlight shines not only on the machinery, but rather on optimum system solutions for integrating molds and individually configured peripheries in the digital and the real world.

At the Fakuma, the visitor will get to see a number of innovations and further developments in the injection molding field. On one hand stand fast-running machine concepts for high quantities at the packaging branch, while on the other concepts are being presented that make injection molding interesting for flexible and variable production of smaller lot sizes. Certainly a central topic in the sense of industry 4.0 is the increasing digitalization

and networking of injection molding machines, for example with peripheral devices or downstream processes. To help the customer take the leap into the digital world, many manufacturers are offering solutions in the form of new software packages as well as assistant and main computer systems.

Also in the spotlight are further developments for special procedures in injection molding, such as multi-component

or foam injection molding. Where fluid silicones are processed, this year's focal point is micro-injection molding. The steady dynamism in the industry is especially reflected in the way many manufacturers are widening their portfolios to present expanded and/or new machine series in the high and/or low locking force ranges.

The Author

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Service

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LWB Steinl

Now Thermoplastic, too

Since 1971, LWB Steinl GmbH & Co KG of Altdorf, Germany, has been known for elastomer injection molding technology. At the Fakuma 2018, the company is presenting injection molding machines for thermoplastics processing for the first time. Among these in particular are vertical machines as they are combined to produce a rotationally symmetric plastic/rubber composite part in a production cell (Fig. 1).

The thermoplastic body made from polyamide 612 with 40 % glass fiber content is produced on a VCRS 500/115 top-closing C-frame machine. This series is available with different closing directions and up to a locking force of 2500 kN. Following a conversion step, the preform is encapsulated with EPDM on a VRF 1100/160 type machine. Gantry frame ma-

chines like this model are generally characterized by very rigid mold support – a prerequisite for producing parts with little or no sprue.

➤ **Hall A4, booth 4123**



Fig. 1. The dual-component shaft seal consists of an outer ring of glass fiber-reinforced PA612 and an inner ring of EPDM rubber (© LWB Steinl)

Fanuc**Efficiency with a Capital E**

The Fakuma highlight from Fanuc Deutschland GmbH, Neuhausen a. d. F., Germany, is the European premiere of its new Roboshot α -S450iA injection molding machine (Fig. 2). Until now, this model series has only been available in locking force ranges of 150 to 3000 kN, but now Fanuc has extended the fully electric series to include a 4500 kN version. Four different screw sizes for the two basic injection units offer the high flex-



Fig. 2. Locking force ranges up to 4500 kN can be handled by the new Roboshot α -S450iA (© Fanuc)

ibility desired by the market. These machines also feature energy recovery control and torque-dependent dosing control. For a longer lifetime, mold safety and ejection protection functions are also included. The production of connectors for infusion components in a 32-fold mold from Kebo AG will be performed by injection molding this complex geometry for large-scale applications with high demands on precision.

Fanuc will also demonstrate highly automated production in a compact cleanroom production cell. Here an automation module for lateral removal on injection molding machines (model: Plasticmate) from its system partner Robotec Solutions AG will interact with a Fanuc Roboshot α -S100iA injection molding machine. A six-axis robot combined with a linear axis (model: Fanuc LR Mate) removes the molded parts from the variotherm operated mold and together with a CR-7iA robot performs assembly steps in the production cell.

In the so-called IOT Corner, Fanuc will show visitors real time monitoring of defined quality parameters, as well as the order status and state of all machines and the robot cell on the booth – in agreement with recognized industry 4.0 requirements. This live demonstration is realized via a Euromap 77 interface and the MES "TIG authentic".

» **Hall B3, booth 3211**

Arburg

Digital Aids for Injection Molding

With six injection molding machines on its fair stand and nine more on partner stands, Arburg GmbH + Co KG of Lossburg, Germany, is showing the way to digital and highly automated injection molding production. The focus is on "smart" machines that monitor their processes, regulate them adaptively, and actively support the operator. Information technical networking of production is realized with the aid of Arburgs host computer system (ALS). An ambient of "augmented reality" and a new customer portal strengthen service offerings. As an eye-catcher, Arburg is presenting its exhibits in a new mint green/light gray/dark gray color design for the first time.

In sharp focus are the six assistance systems introduced during the recent technology days in Lossburg. They support the machine operator during setup, when entering processing parameters, and for optimizing the process (4.set-up and/or 4.optimisation). In addition, the process startup can be organized more efficiently (4.start-stop), and both quality and process monitoring can be improved, as well (4.monitoring). Experienced operators get more freedom to program functions (4. production), and customer service via online-support has been improved by enabling Arburg technicians to directly access the machine control (4.service), for example. This is mainly realized by a new, cloud-based customer portal that makes various services available via central applications (Apps), such as "machine overview" and "replacement parts catalog".

For data recording and archiving, as well as to visualize the entire process, the injection machine manufacturer Arburg is announcing a new solution: the Arburg Turnkey Control Module (ATCM). This data collector for complex turnkey systems is demonstrated on an Allrounder 470 A electric injection molding machine with 1000kN locking force that produces two housing parts of a level in a family mold. In addition to automatic assembling, the production cell performs several testing steps and also labels the levels with a QR code. Via OPC-UA interfaces, the ATCM collects infor-

mation from the injection process and the camera tests and assigns it to the individual part via the QR code. The visitor can read out the corresponding process data on a smartphone on a part-specific website.

Arburg demonstrates (as it did last year) how individual customer wishes can also be

achieved, it achieves greater dynamics and reproducibility. Moreover, injection speeds of up to 500mm/s are possible. At the Fakuma, thin-walled containers (capacity 500ml) will be produced in a 4-fold mold and labeled in-mold (In-Mold Labeling) during production. One cycle lasts approx. 3.8 s.



Fig. 3. The Gestic control – one stage of the journey toward the digital future of plastic parts production (© Arburg)

included online in a running injection molding process using elastic wire ropes as example. In this fair application, the visitor can choose between different versions and have his order entered directly on a terminal. In the next step, the desired version is produced without a setup step on an Allrounder 375 V vertical machine.

On exhibit for the first time is a special "packaging" version of the Allrounder 320 H hybrid machine in new design and with Gestic control (**Fig. 3**). The machine boasts 3700kN locking force plus a modified injection unit and is configured for fast-running applications in the packaging industry. Thanks to specially adapted valve technolo-

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Arburg continues to emphasize the processing of fluid silicones. In an injection molding production cell, an Allrounder 270 A electric machine with 350kN locking force will demonstrate the production of micro-parts in the case of a 38mg heavy slit valve. First the fluid silicone is mixed in a cartridge and then it is injected into a 4-fold mold by a micro-injection unit (size 5) with an 8mm screw.

One machine, an Allrounder 570 E Golden Electric with 2000kN locking force, is dedicated to precision injection molding. The demonstrator, a technical housing part that holds optical components, is produced in a cycle time of 55s.

➤ **Hall A3, booth 3100 and 3101**

KraussMaffei

Function and Decor in a Single Step

Both frame décor and electronic equipping in one cavity – while in the neighboring cavity another part is being equipped with a dead-front design. At the Fakuma, KraussMaffei Technologies GmbH of Munich, Germany, is showing how far production integration has come in the meantime. For this, the machine manufacturer has expanded the locking force spectrum of its fully electric PX series upward (3200 kN) and downward (250 kN).

The larger injection molding machine, a PX 320, will produce a ten-inch display with integrated electronics, black décor frame, and scratch resistant coating (**Fig. 4**). This process combines IMD and IML processes (In-Mold Decoration/In-Mold Labeling) in a single production step. To do this, a six axis robot on the nozzle side inserts an IML film with printed circuitry that is back-injection molded once the mold is closed. At the same time on the ejector side, an IMD film with single image décor runs through the mold, transferring its design to the part with a layer of UV hardened lacquer. Next to the IMD film for the display, another one runs parallel through the mold, serving a second cavity with a different décor. This is enabled by the IMD SI Duo film feed from Leonhard Kurz Stiftung & Co. KG, the worldwide first one to position two single-image decors independently of each other to hundredths of a millimeter. Using multi-cavity molds, processors can considerably increase output and flexibility in applications of this type.

The second décor symbolizes a so-called dead-front optic that reveals previously invisible function symbols only when back-lighted. Besides equipment for injection molding, the production cell includes a laser station where flakes and flitter are removed first and then the sprue is separated, as well as a cleanroom hood from Max Petek Reinraumtechnik GmbH & Co. KG. A UV-station for hardening the lacquer is also integrated into the production cell, but is not active due to safety regulations.

The smaller machine, a PX 25 SilcoSet, produces microprecision parts weighing 0.16 g in a cycle time of 14 s. This involves a sealing ring with a filigree undercut made from LSR. Especially for this, a plasticizing unit with a 12 mm diameter screw was developed and supplemented by a spring-loaded non-return valve.

» **Hall A7, booth 7303**



Fig. 4. A complete 10-inch HIM display is produced in a single step on a PX 320
(© KraussMaffei)

Trexel

Good Chemistry

For many years, Trexel GmbH of Siegen, Germany, has been a well-known supplier of the MuCell process for foam injection molding. At this year's Fakuma, the company is coming out with new applications such as foamed thin-walled packaging and a product portfolio expanded to include propellants and foamed blow-molded parts.

For many parts, weight savings are the main reason for using thermoplastic foam-injection molding. Thin-wall packaging, however, profits also from improved melt flow, since viscosity is reduced by including a propellant. Lower inner wall pressures are the result, so that the manufacturer can claim an approx. 30% reduction of the locking force required – thereby enabling the use of smaller machines. This way, packaging parts can be made 20% lighter and thinner-walled, even with a thicker sealing rim at the end of the flow path. For such applications, Trexel has developed its new P series MuCell gas dosing devices (Fig. 5). They are

characterized by dosing regulation adapted to short plasticizing times, high dosing precision, as well as reproducible process constancy and stability.

For the established T series dosing systems, Trexel is presenting a satellite model for physical foam injection molding in a new, more economical beginner version. Additional machines can be included at low expense in combined production cells in particular. So-called booster stations available in two power ranges assume the supply of propellant to the individual satellites.

Trexel is offering an additional innovation, a solution for chemical foam-injection molding named TecoCell. The patented chemicals in TecoCell are claimed to be far superior to conventional propellants. The use of 0.08 µm small CaCO₃ particles has a uniform microcellular foam structure as a result – with a simultaneously large weight reduction as well as good mechanical properties and surfaces.

➤ **Hall A4, booth 4007**



Fig. 5. The new P-series gas dosing devices are configured for the foam-injection molding of thin-walled packaging (© Trexel)

Promix

The Mixture Does It

Promix Solutions AG of Winterthur, Switzerland, is presenting solutions from its core competencies mixing, foaming, and cooling

for plastics processing at the Fakuma. Besides injection molding processing, film extrusion is right up front.



Fig. 6. Compared to the standard 2C process, the mixing nozzle eliminates color streaking (left) in the soft component (© Promix)

The avoidance of flow lines is the big challenge when hard/soft parts are produced by 2C injection molding. Similar difficulties occur when processing TPE, because to achieve the desired color range often requires high masterbatch contents. Quality problems can be eliminated at low expense by replacing the existing machine nozzle with a mixing nozzle.

Promix will present examples from both application areas. For instance, a mixing nozzle can eliminate color streaking in the soft component (TPE) of an inert gas welding device produced by 2C injection molding (Fig. 6). In another case, the use of a mixing nozzle can not only eliminate color streaking in hand grips for measuring devices from TPE, but also reduce the masterbatch content from 7 to 2.5%.

➤ **Hall A2, booth 2105**

Toyo/Deckerform Foamed and Stamped

Last year, Toyo Machinery & Metal Co, Ltd. of Akashi City, Japan, and Deckerform Produktionssysteme GmbH of Aichach, Germany, emphasized fast-running applications on their joint stand. This year, both companies are mainly demonstrating special injection molding process, e.g., thermoplastic foam injection molding and injection-compression molding. Machine manufacturer Deckerform has been the exclusive sales partner for the Japanese injection molding machine manufacturer since 2017.

With the production of a sandwich board on a Toyo Si-280-6 machine with a locking force of 2800 kN, they will demonstrate foaming with chemical propellants in combination with negative mold embossing. During the foaming process, the cavity is expanded in less than 60 s

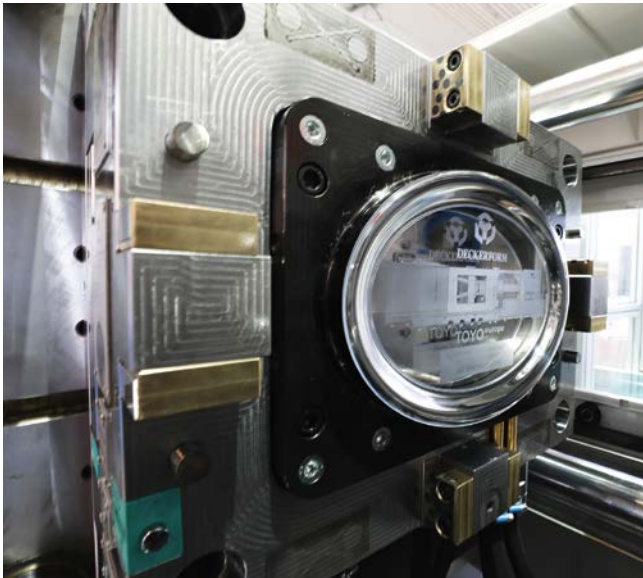


Fig. 7. A serving tray weighing 130 g is injection-compression molded on a Toyo Si-100-6 with a locking force of 1000 kN (© Deckerform)

from a 3 mm wall thickness to an approx. 8 mm in the positive mold manufactured by Deckerform. The foamed parts combine low weight with good weight-specific mechanical properties. The good noise and thermal insulation of foamed parts makes them especially interesting to the building construction and automobile industries.

On a Toyo Si-100-6 machine with 100 kN locking force, the partners will show how a serving tray is produced by injection-compression molding in a cycle time of approx. 18 s (**Fig. 7**). The 130 g heavy polystyrene part with 3 mm wall thickness is about the size of a sheet of letter paper. In this process a positive mold performs the compression stroke. Compared to standard injection molding processes, injection-compression processes can produce parts with lower shrinkage and more uniform density. An additional positive effect is the reduction of the locking force required which, in this case, could be lowered from approx. 1300 to 600 kN. This enables the use of more economical, smaller machines.

➤ **Hall A6, booth 6317 and 6413**

Engel

Assisted and Produced in Many Ways

For 2018, Engel Austria GmbH of Schwertberg, Austria, is presenting highly integrated production solutions for small lot sizes in order to image them with the same efficiency and economy as large series. One topic here is rapid mold changing. A six-axis robot and – in a premiere – a fully electric and tiebarless e-motion TL of the new class stands at the center of a production cell. Its 1200 kN locking force makes it the largest machine in its series. Thanks to the tiebarless design of the locking unit, it is especially suitable for large or bulky injection molds with many cavities or core pullers and guide bars. At the Fakuma, the machine will be combined with a special mold from Braunform GmbH that is equipped with a patented fast-changing mechanism.

By changing mold inserts fully automatically, various versions of a caliper gauge made from ABS will be produced here. So that as few rejects as possible are produced between insert changes, use is made of three assistance systems from the "inject 4.0" series. They regulate the volume of melt injected (iQ weight control), set the optimum locking force (iQ clamp control), and adapt the pump capacity of the temperature control units based on temperature differences (iQ flow control).

A duo 1060/350 injection molding machine will demonstrate developmental progress in the so-called Foilmelt technology by producing variously decorated, three-dimensionally complex sample parts. The process is realized together with partner companies



Fig. 8. A fully electric e-cap 380 injection molding machine produces beverage closures in a cycle time of less than 2 s (© Engel)

Leonhard Kurz Stiftung & Co. KG, Schöfer GmbH and Isoport Verbundbauteile GmbH. The name "Foilmelt" designates a continuous IMD process (In-Mold Decoration) based on a roll-to-roll process. In addition to multilayer film systems with lacquer surface or embedded capacitive electronics, structured, back-lighted, and open pore systems such as wood can be formed and back-injection molded by this method.

Changes among different semifinished films can be done flexibly by a simple roll change, so that the process becomes interesting for widely varied production in small lot sizes. Among the target group are manufacturers of visual components for car interiors, the teletronic and white goods industries. At the same time, the guard housing newly developed by Engel will be presented in the production cell. It is available for all automated in-

jection molding machines and integrated system solutions and features high flexibility, modularity, and simple assembly.

Engel's e-cap series shortens the cycle time in the production of beverage closures. This is the only fully electric machine type on the market that is specialized for closure applications and is available in locking forces up to 4200 kN. At the Fakuma, an e-cap 380 (Fig. 8) will simultaneously produce 72 HDPE closures with a diameter of 26 mm (incl. originality band) in a production cell with integrated dry-air and camera testing systems in less than 2s. According to the manufacturer, with optimized movements the machine achieves a cycle time of approx. 1.4s in dry running. At the same time, the machine boasts the very low power consumption of 0.4kW/h per kilogram of granulate processed.

➤ **Hall A5, booth 5204**

Linde

Just Foam

Linde AG of Düsseldorf, Germany, is presenting its portfolio of processes, systems, and services for gas-assisted processes in the plastics processing industry on the booth it will share with Maximator GmbH. The spotlight is on its "Plastinum Foam Injection Molding", a thermoplastic foam-injection process developed in cooperation with the Kunststoff-Institut von Lüdenscheid (KIMW) and the ProTec Polymer Processing GmbH. Prior to insertion into the injection molding machine, pre-dried plastic granulate is loaded with CO₂ physical propellant (Fig. 9).

Compared to other physical foam injection molding processes, the investment costs are

low, simply because several machines are fitted with one "Plastinum Perfoamer" unit that can also be retrofitted to existing machines. This process enables the typical advantages of foam-injection molding to be utilized, such as reduced part weight and shrinkage, as well as the lower locking force required. The manufacturer claims the process is especially suitable for shear-sensitive plastics, such as long fiber-reinforced thermoplastics (LFT granulates), since it scarcely damages the materials. Both KIMW as well ProTec will demonstrate this method in processes running on their booths.

➤ **Hall B3, booth 3309**



Fig. 9. Loading the granulate combines the simple handling of chemical foam process with the positive effects of physical foaming

(© Linde)

Dr. Boy

A Ruler for Measuring Follow-Up

With 15 exhibits all-in-all and seven on its booth in Friedrichshafen, Dr. Boy GmbH & Co. KG of Neustadt-Ferndthal, Germany, is presenting almost its entire machine portfolio. Foci among the fair exhibits represent solutions for increasingly digitalized production and rising levels of automation. The company will

an additional Boy 2C S injection unit partially oversprays the cup in the same mold with a wall made from a thermoplastic elastomer (TPE) (**Fig. 10**).

But the machine manufacturer in Rhineland-Palatinate has saved the biggest surprise

for itself. In a press release, the company has announced “an absolute innovation” with which they are expanding their own model portfolio and offering its users “an optimum of additional use possibilities”.

➤ **Hall A7, booth 7101**



Fig. 10. The production line for the 2C cups is fully automated (© Dr. Boy)

celebrate its 50th anniversary by producing body parts of an old BMW on one of Boy's first injection molding machines (Boy 15).

A new production cell will unite a Boy 60 E injection molding machine, a Boy LR 5 removal handler, as well as an integrated scanner and printer. On the booth, multifunctional rulers will be produced that are printed with a QR code following removal from the mold. This enables the data of each part produced to be subsequently called up and assigned. The digital connection of the machine to a main computer and to automation and peripheral equipment is enabled by a Euromap interface.

Additionally, the LR 5 removal handler will go into action and exemplify a multi-component application by producing cups. In the process, the thermoplastic cup body made from food-safe SMMA copolymer is first injected. Then

Wittmann Battenfeld

Networked at all Levels

Wittmann Battenfeld GmbH of Kottlingbrunn, Austria, will present its new VPower series and otherwise emphasizing digital monitoring and assistance systems, as well as applications from multi-component injection molding. In hourly presentations, visitors will be treated to the topics integration, HiQ assistance systems, and CMS (Condition Monitoring System) – a machine-state monitoring system.

Highlighted for the fair will be the premiere of the new vertical VPower machine featuring high energy efficiency, compactness, and user friendliness. At the Fakuma, a VPower 160/750 will be exhibited as the first representative of the series (Fig. 11). With it, the company's vertical machine series is also being shifted to the PowerSeries design. The machine is equipped with an openly accessible roundtable (1600 mm diameter) that enables simple transport of insert parts and removal of finished parts. The roundtable comes with a servo-electric drive and is configured for short turn times. The absence of a center tie bar enables central medium supply through the rotary table from below, or the installation of a compact rotary distributor. The plasticizing unit can be switched from vertical to horizontal (and vice-versa) even after commissioning.

With the introduction of new models, the fast-running fully electric EcoPower Xpress machine series has been expanded in the lower locking force segment. During the fair, the smallest machine in the series will produce labeled PP covers by an IML process in a four-fold mold in a cycle time of approx. 3 s. The machine is equipped with the company's own Condition Monitoring System (CMS) that



Fig. 11. The new VPower 160/750 expands the machine portfolio in the area of vertical injection molding machines © Wittmann Battenfeld)

enables continuous condition monitoring of the most important parameters.

Two exhibits will be dedicated to multi-component technology. A teachbox housing for the R9 Wittmann robot control will be produced from ABS and TPU on a SmartPower 240/750H/210S servo-hydraulic machine in a single cavity mold. The preforms are then shifted to a second cavity for encapsulating

with the second component. Then a QR code is printed on the surface by an inkjet printer that makes the part including its production data traceable.

The second exhibit involves a sensor part for a medical measuring device in microformat. The spherical-shaped, filmy TPE membrane in the molded part serves to measure a specific pressure within the measuring device. Both components are processed under cleanroom conditions. The MicroPower 15/10H/10H is especially configured for producing 2C mini-parts. Moreover, together with a Wittmann W8V54 Scara robot adapted for the machine, a camera system integrated into the machine monitors part quality fully automatically.

Machine and periphery networking by "Wittmann 4.0" will be demonstrated on an EcoPower 90/350. This enables robots, tempering devices (Tempro), gravimetric dosing equipment (Gravimax), dryers (Drymax), and throughput regulators (Flowcon) to be integrated into the Unilog B8 machine control. Quality data from machine and periphery can be read out for documentation. For servicing, the Wittmann 4.0 Router enables secure access online to all data modules of a production cell via a single IP address (Single Point Entry). The electronic data sheet represents an innovation by which all devices in a production cell can be configured according to a selected mold data record. Via the "Plug & Produce" mode, the production cell can be ready to produce on short order.

At the same time, the machine is equipped with a HiQ Flow, HiQ Melt, and HiQ Metering software package to demonstrate the function of these assistance systems. With HiQ Flow, temperature and charge variations can be compensated by viscosity-oriented injection regulation, while HiQ Melt enables direct monitoring of material quality via the energy consumed by plasticizing. Via HiQ metering, shot weight reproducibility is increased by actively closing the non-return valve.

» **Hall B1, booth 1204**

Conclusion

Constantly increasing demands on quality, flexibility, and efficiency in the production of plastics products require the advancement of digitalized production and machine component networking in particular. Machine and system manufacturers are mastering this challenge by offering more and more made-to-order assistance and monitoring systems. Above and beyond this, there is great demand for the increasing integration of further processes in the injection molding cycle in the form of compact production cells.