The magazine for the injection molding world

Wittmann innovations

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Top-quality products – maximum efficiency

Bosch Siemens Hausgeräte sets up completely new injection molding production with MacroPower two-platen machines

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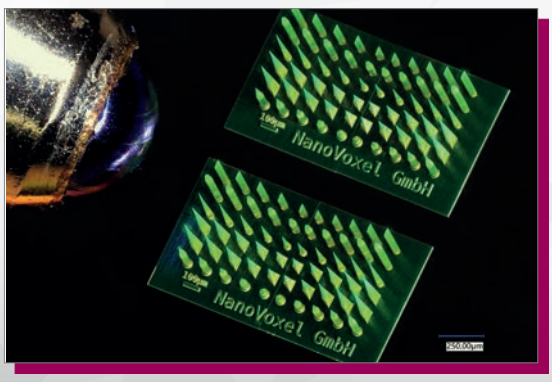

Content
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Editorial office: WITTMANN Technology GmbH, Lichtblaustraße 10, 1220 Vienna, Austria – Editors: Gabriele Hopf, Susanne Zinckgraf
Layout: Carolina Novoa – Tel.: +43 1 250 39 0 – gabriele.hopf@wittmann-group.com – www.wittmann-group.com

WITTMANN Technology GmbH
Lichtblaustraße 10
1220 Vienna
Austria
Tel.: +43 1 250 39-0
info.at@wittmann-group.com
www.wittmann-group.com

WITTMANN BATTENFELD GmbH
Wiener Neustädter Straße 81
2542 Kottingbrunn
Austria
Tel.: +43 2252 404-0
info@wittmann-group.com
www.wittmann-group.com

Editorial

Dear Readers,

The stuttering of the automotive icon Volkswagen – much discussed and prominently present in the media – is a symbol of the current transformation process. The motto "What must not be cannot be" has become obsolete, as can be clearly seen on the case of Volkswagen. Industrial enterprises, even those previously perceived as a rock in a stormy sea, cannot escape from the permanent pressure for change.

It is well known that our plastics industry is also undergoing a transformation phase, which could be seen everywhere at this October's Fakuma. Currently, the ongoing transformations seem to be more diversified and varied than ever before. As long as I have been active in the plastics industry – and this year I am completing my 35th year of service – I have never before felt such strong pressure and occasionally even compulsion for change. The transformation processes include comprehensive technological adjustments and more extensive use of digitalization to increase efficiency, but also involve social changes due to the demographic development in many countries, as well as structural and regulatory challenges, which are particularly pronounced among companies in the German-speaking region.

The main themes of the Fakuma have dealt very effectively with some important aspects of these transformations: digitalization, circular economy and sustainability. We presented our solutions there on site, including numerous innovations to cope with the imminent challenges, and we were glad to see that these met with such a positive response from you, our customers. The Fakuma 2024 has exceeded our expectations (see page 4). Let me now take this opportunity to express my sincere thanks to all visitors of our booth at the fair.

As an important novelty and investment in the future, a Career Friday was organized for the first time at this Fakuma, which attracted a large crowd of young people to Friedrichshafen and proved very successful from our point of view. The senior high school students who visited our booth were impressed by the great diversity of our industry, by our commitment to sustainability and by the excellent opportunities available to career starters in the plastics industry.

With this issue, "innovations" is also undergoing a transformation. So, if our customers' magazine now looks a bit unfamiliar to you, this is due to its new layout. From now on, you will already find orientation and an overview on the title page, helping you to pinpoint even more quickly the most interesting topics for meeting your daily challenges. What has remained unchanged is the magazine's high-quality content, including numerous exciting user reports and presentations of new products and technologies, as well as latest news from the WITTMANN world. It is always a great pleasure for me to see the great dedication and care shown by our editors and graphic designers in selecting and presenting the contents of innovations.

We all, staff and management of the WITTMANN Group, now wish our readers wholeheartedly a happy and successful New Year 2025.

See you soon!

Yours, Michael Wittmann

Fakuma 2024 sends positive signals

The Fakuma 2024 in Friedrichshafen was extremely positive for the WITTMANN Group. The visitor frequency was very satisfactory, the number of orders placed at the fair was on a par with those received at the Fakuma 2023. The Career Friday proved to be a highlight.

CEO Michael Wittmann (center right) and Max Rusch, trainee at WITTMANN BATTENFELD Germany (center left), showing the exhibits at the WITTMANN booth to a group of senior high school students.

Even though this cannot yet be seen as a turnaround, we can safely say that some positive signals have come from this fair", Michael Wittmann, owner and CEO of the WITTMANN Group, comments with pleasure on the positive outcome of the fair. "The Fakuma 2024 has significantly exceeded our expectations. The visitor frequency was good, and of course we are glad about the resulting order intake".

With five injection molding machines, eight robots and more than 65 exhibits of auxiliary equipment, the WITTMANN Group was prominently present at the fair. The exhibits showed a representative cross-section of innovations and novelties from all segments of the company's product portfolio and were arranged along a path of performance and efficiency indicating the most relevant saving potentials.

SmartPower now also with an electric injection unit

A SmartPower Combimould injection molding machine equipped with a servo-electric injection unit celebrated its world premiere at Fakuma 2024. From now on, the WITTMANN Group is offering the machines from the SmartPower series across its entire range of clamping force sizes from 380 to 4,000 kN with a choice of either a servo-

The new hybrid SmartPower celebrated its world premiere at the Fakuma 2024. It produced bottle openers with multi-component technology.

Tomorrow's mechatronics engineers. Many younger children also took part in the Career Friday and were particularly fascinated by the robots at the WITTMANN booth.

A high school student (2nd from left) at the WITTMANN booth. Matthias Joos, Justin Paitsch, Michelle Schaller and Lisa Csajkovics (from left to right) were the contact partners for the young trade fair visitors on Career Friday.

hydraulic or a servo-electric injection unit. In its hybrid version, the machine combines the advantages of the servo-hydraulic SmartPower in terms of its flexible, generously dimensioned mold space with those of the all-electric EcoPower machines, offering highly dynamic control with maximum shot-to-shot repeatability.

Optional functions such as active injection, servo-dosing or high-speed injection, which previously required an energy-intensive hydraulic accumulator, can now be taken over by the servo-electric injection unit. Parallel dosing with a positive effect on cycle times and consequently on production expenses is included in the delivery of this variant at no extra cost.

At the Fakuma, the new hybrid machine, designed as a compact Insider solution, produced bottle openers using multi-component technology. The integrated robot inserted the metal parts, which were presented to it in a magazine, together with the decorative foil into the mold. There they were over-molded with polycarbonate. Following rotation of the mold, the resulting base body was over-molded with TPE in order to obtain a better grip.

DC technology for Brazil

Once again, DC technology was a magnet for visitors. WITTMANN is the pioneer in the injection molding world when it comes to using energy generated from photovoltaics via a local DC grid directly, without conversion loss, to operate injection molding machines. During the Fakuma, another DC injection molding machine was sold to a customer in Brazil.

WITTMANN was also successful and received orders in all other product segments during the five days of the fair. Although the total numbers of visitors were below those of the previous year, the decision-makers were definitely present on site.

Career Friday proved a great success

A special highlight at the Fakuma 2024 was the Career Friday, which was already actively supported by the WITTMANN Group prior to the fair. WITTMANN managed to recruit well over 300 senior high school students and trainees for this event from Austria alone and organized its own buses for their transfer to Friedrichshafen.

The young visitors to the fair gathered information about career prospects in the plastics industry, made contacts and simultaneously showed a keen interest in the technical innovations presented. So, the Career Friday offered them a great opportunity to familiarize themselves with the plastics industry's commitment to sustainability. >>

"Unlike at school, we are shown here not only the theory, but also the practice and how this is going to develop in future. We are getting many new ideas", a school student said at the WITTMANN booth. "This fair is very diverse", another student commented. "I am surprised to see how many different processing technologies there are". Trainees and career starters from the WITTMANN Group served as contact partners for the young visitors throughout the whole day of the fair. They described their daily work and confidently presented the innovations from WITTMANN.

"The Career Friday was a fantastic experience for us", says Michael Wittmann. "Here we had the opportunity to show the young people that the plastics industry has any number of solutions to offer. If we want to do something about protecting our environment and the climate, the plastics industry is a good place for doing it. The Career Friday brought this message across very effectively."

Visitors' comments

I very much like to visit the WITTMANN booth every year. We are long-standing customers, are using many of their robots and are always glad to be inspired at the fair, for example about energy efficiency. People look more and more closely at sustainability. Energy costs are extremely high, and here we receive optimal advice from WITTMANN. This helps us of course to increase cost-efficiency.

Zlatko Roginic,
Production Manager at Gebr. Schwarz GmbH, Rottweil-Neukirch, Germany

Energy efficiency has definitely emerged as a major topic in recent years. We are currently replacing old machines with new ones, and here WITTMANN BATTENFELD is providing comprehensive support by sending us energy consultants and carrying out energy measurements. We are very satisfied. For every production line, we save on average about 30 per cent as soon as we replace old machines with new ones.

Tobias Fröbel,
Owner-Manager of Fröbel GmbH, Blaufelden, Germany

I came to WITTMANN with a purpose, because we are planning a joint project and I was eager to see their exhibits. We have tested Cellmould and Airmould with poor-flowing materials whose compositions are not homogeneous. A representative example are coat hangers produced using a material fraction made of former canisters coming from Sub-Saharan Africa. Some ideas have come up, which we now have to discuss further. If we want to implement recycling, we have to tackle it.

Dieter Gottschalk,
Co-Founder, Wildplastic GmbH, Hamburg, Germany

More about the Fakuma innovations

can be found in the detailed trade fair preview published in the previous issue of innovations.

Calculate product carbon footprint automatically

The Product Carbon Footprint (PCF) creates transparency about the climate impact of products. However, the calculation can be correspondingly complex. This is why WITTMANN has added a new function to its MES TEMI+. Thanks to the integrated material database, the software calculates the PCF automatically.

By 2050, the EU wants to be climate-neutral. The resulting Green Deal will make it mandatory for manufacturing companies to gradually reduce their CO_2 emissions. The product carbon footprint (PCF) is therefore coming into focus. Information about the carbon footprint of individual products is a prerequisite for implementing effective measures to reduce greenhouse gas emissions.

The PCF includes emissions from the entire life cycle of a product – from raw material production to recycling. With WITTMANN, however, the calculation is very simple.

Including energy consumption and material data

As soon as a production cell is clicked on the extended dashboard of the TEMI+ solution, the processor receives a complete overview of the production progress. The relevant key figures are displayed for each individual cycle. The CO_2 emissions are now added there – each indicated in grams per cycle. When using a single-cavity mold, this value corresponds to the PCF. When using multi-cavity molds, this value is divided by the number of cavities to obtain the PCF.

The calculation of CO_2 emissions is based on two values. One is the energy consumption of the injection molding production cell and the other is the shot weight, in other words, the amount of raw material processed per cycle.

The energy consumption of the production cell is automatically measured cycle by cycle either directly by the MES or by using the iMAGOxt software. iMAGOxt is the cloud-based energy management software from WITTMANN that provides transparency for all energy consumers in production operations.

The CO_2 emissions resulting from the energy consumption depend on the production location. For Germany, for example, with the current electricity mix, the factor is 0.354 g CO_2 per Wh. This value is stored in the TEMI+ or shared from the customer's ERP so that the system can automatically calculate the CO_2 footprint of the production cell.

The CO_2 footprint of the raw material is also a predefined value. It is provided by the material manufacturer and entered into the TEMI+.

The TEMI+ dashboard shows the product carbon footprint at a glance and indicates the share of the injection molding process and the share of the material in the total emissions.

Top-quality products with maximum efficiency

For the BSH washing machine production plant located in Łódź, Poland, the change to a new generation of appliances led to a new production strategy. Injection-molded parts, which had long been outsourced from external contractors, are now manufactured in-house. The injection molding partner WITTMANN supported the new injection molding facility's development by delivering large MacroPower machines – each equipped with an extensive automation package.

The light green and gray housing halves are welded together to enclose the washing drum inside the finished washing machine. Most recently, BSH in Poland produces both of these injection-molded parts in its own injection molding shop.

With the development of our new appliances, we have responded to current customer demand", explains Dr. Andrzej Pirek, Head of Department of Manufacturing Engineering, during our visit to BSH Sprzęt Gospodarsrwa Domowego Sp. Z o.o. in Łódź. "All our washing machines now come with the highest energy efficiency class A. They also consume less water and run at a lower noise level." The lion's share of the washing machines manufactured in Łódź are destined for European markets. Mainly the global brands of Bosch and Siemens are made at this location.

Andrzej Pirek always keeps a close watch on the behavior and wishes of the consumers. Energy savings and more sustainability are the order of the day, and this is where households and production plants are in a very similar position. "Our aim is to make top-quality products with a long service life and maximum efficiency", says Pirek. "Here, the injection molding technology from WITTMANN makes a significant contribution. Both the MacroPower injection molding machines' process stability and their low energy consumption have a very positive effect."

As the factory grew, new platforms and new processes emerged. This year, the site is celebrating its 30th anniversary. Aligned with appliances, development, all processes were analyzed. "We realized that we could tap a great savings potential by making the injection-molded parts ourselves", Pirek reports.

Number of good parts exceeds target

On the day of our visit, several MacroPower injection molding machines – all with 900 tons clamping force – are standing in a row in the new injection molding hall. No less impressive are the components the linear robots are removing from the molds and stacking on pallets placed directly beside the machines. There are two different types of round parts, both very large and complex with many connection and assembly elements, destined to enclose the washing drum later on in the end product, after they have been joined together. Both housing halves are injection-molded from fiberglass-reinforced polypropylene, each with the remarkable shot weight of just under 4 kilograms.

On the pallets, the freshly molded parts are first brought to an RFID-controlled FIFO storage facility, until they have reached their final geometry. From there, they are passed on directly to an assembly line in the neighboring production hall. There, the two housing halves are welded together using vibration welding. "For the quality of the weld seam, there is zero tolerance. The drum must be absolutely watertight to prevent leaks in the washing machine", explains Pirek. The prerequisite here is extremely precise forming of the geometrically complex parts by injection molding. Here, the MacroPower injection molding machines bring their strengths into play with highly accurate servo-hydraulic movements and a reliably constant injection molding process. "Our scrap rate is below our original target", comments Pirek with pleasure.

Systematic development of injection molding expertise

With its own injection molding facility, BSH has significantly increased the vertical range of manufacture at its Polish washing machine plant. All the important value creation stages now take place in-house, which has a positive effect on unit costs and consequently competitiveness. The new strategy is now paying off, but a number of obstacles had to be overcome to get there.

For the workforce in Łódź, injection molding was a completely new technology. Here,

WITTMANN BATTENFELD Polska supported the project with an extensive, tailor-made training program. "We not only trained the machine operators, but also the maintenance and security staff, and the process engineers, too", says Bogdan Zabrzewski, Managing Director of the WITTMANN subsidiary in Poland, located in Grodzisk Mazowiecki, only 100 km east of Łódź. "The short distances are a definite advantage. Whenever we are needed, we are always quickly on site", Zabrzewski comments.

The location also benefited from the global production network of the BSH Group. The same washing machine models are produced in other countries, too, and certain injection-molded parts were already manufactured in-house there for earlier generations of appliances. "We cooperated very closely with our colleagues from other countries, and were thus able to learn a lot for our new injection molding shop", Pirek reports. 'Network of Experts' is the designation of this concept

They are proud of the "Project of the Year" award: Adam Sobczynski, Process Engineer, and Andrzej Pirek, Head of Manufacturing Engineering, at BSH, together with Bogdan Zabrzewski, Managing Director of WITTMANN BATTENFELD Polska (from left to right).

At the BSH plant in Łódź, all MacroPower injection molding machines are equipped with W863 pro linear robots.

at BSH, which functions for all technologies being used within the Group. All locations are part of a digital network. "Industrie 4.0 makes cooperation beyond the boundaries of individual locations very simple", says Pirek.

Automation made to measure

The housing geometry of the new washing machine generation, however, presented all production sites with a new challenge. "We had to completely re-design our automation concept", says Zabrzewski. Starting with the grippers and all the way to stacking the molded parts on pallets for transport to FIFO storage.

The W863 pro robots with a maximum load capacity of 75 kilograms perform several different functions. They insert the bearing bushes into the mold to be over-molded, demold the housing halves and stack these on the pallets according to a preprogrammed storage pattern. To handle the pallets, WITTMANN has developed a multi-level conveyor system. The pallet exchange is carried out fully automatically. The pallets are prepared for collection on the upper level of the conveyor belt >>

Trimmed for efficiency: the new injection molding facility achieves a high automation level.

while an empty pallet is moving up from the lower level at the same time.

Another special feature is the integration of the robot's control system in the production cell. The robot program is downloaded via the injection molding machine's control system, with an RFID code to ensure that the correct gripper has been attached.

"The success of this project is the result of extremely close cooperation between the process experts at BSH, the automation specialists at WITTMANN in Germany and our local technical lab at WITTMANN BATTENFELD Polska", says Zabrzewski. BSH benefits from the fact that the injection molding machines and the automation equipment have all come from a single source. "That was our target from the very beginning", says Pirek. "We had only one central contact partner for the entire project and are convinced that this was why we were able to start up the system so quickly and smoothly."

The availability of the machines is vital. They must be "ready for production" at any time, as Bogdan Zabrzewski emphasizes. For there is no production of goods to be kept in stock. If the injection molding production came to a halt, this would also immediately bring the assembly line to a standstill. So, reliability in service was another decisive argument in favor of choosing WITTMANN as injection molding partner. In any case of trouble, the WITTMANN service engineers are very quickly on site. Particularly critical spare parts are kept in stock.

Washing machines are manufactured at the plant in Łódź primarily for the European markets.

"Within the walls of our plant, we have built up a completely new factory. Without WITTMANN, we would not have been so successful in this project", emphasizes Pirek, and praises above all the very open communication as an essential success factor. "Here, the right people are working together. People with a lot of knowledge and experience communicating openly with each other at any time. The plant in Łódź has now become the benchmark within our production network."

A wonderful confirmation of this success story came in the form of a special award. Project Leader, Michał Zimowski and his team had submitted an entry for an internal BSH award contest. From a total of 50 projects submitted, the foundation of the injection molding facility in Łódź was chosen as Project of the Year 2024.

A second life for production scrap

It all began some 30 years ago with a mold-making shop, but since then the family-owned company has made a name for itself as a contract injection molding business, producing mainly technical parts for the automotive and electronic industries from a great variety of thermoplastic materials. The company has committed itself to sustainability and high-quality production processes. For inline recycling, they invested in granulators from the WITTMANN Group.

Designed as an Ingrinder production cell, the in-line recycling system requires hardly any additional space. The sprue need not leave the protective housing of the machine to be transferred to the granulator.

Drivers towards inline recycling were primarily the rising prices of raw materials and the shortage of certain plastic materials", the Production Manager reports. "We have now been able to cut our production costs and are avoiding large quantities of waste." The need for virgin material has been significantly reduced. Both sprue and scrap parts are reground inside the new granulators. "The advantage of inline recycling is that we obtain very clean, unmixed recyclates", the Production Manager continues. "For some time now, sprue has been no longer just waste, but instead raw material won directly here on site from our machines."

The screenless granulators from the S-Max series operate with low rotational speeds of 27 rev/min at 50 Hz for extremely efficient, low-cost granulating of sprue and scrap parts.

The machinery includes nine injection molding machines with clamping forces ranging from 50 to 400 tons, fully utilized for eight hours per day on five days a week. All machines are fitted with robots. The entire auxiliary equipment also comes from WITTMANN: dryers, gravimetric blenders and now, most recently, the new granulators for automatic mechanical recycling.

Flexibility is a vital issue

For many customers, the company is not just a contract injection molding shop, but also a development partner. It covers the complete range from design development, construction and mold-making right up to series production. In each case, the optimal production process is developed jointly with the customer. The injection molding specialist also supports its customers in selecting materials and processing methods. Here, it is decided how high the percentage of regrind may be for each part. For the range of parts produced in-house, this proportion varies up to a maximum content of 20 per cent.

In order to facilitate processing and to obtain optimal product quality, the regrind should have a similar grain size to that of the virgin material, be homogeneous and as far as possible free of dust and fine fractions.

The contract injection molder chose screenless granulators of the S-Max series from WITTMANN. These offer great flexibility for efficient, low-cost granulation of engineering plastics as well as styrene, acrylic and fiber-glass reinforced materials.

The S-Max granulators operate at low rotational speeds, which means a high torque. The advantages are less wear on the grinders, longer maintenance cycles, a reduced noise level, less power consumption, less kickback during operation and smooth, even grinding.

The S-Max granulators are also extremely compact, so that they fit into narrow spaces. Their large hopper opening favors easy automation of the recycling process. The hoppers are compatible with all sizes of robot and conveyor belt discharges.

The contract injection molder uses the S-Max granulators also for brittle materials, thick-walled sprues and materials with a high fiber-glass content, invariably obtaining an even, clean granulate free of long fibers.

"WITTMANN is the right partner for us, because there we get all components from a single source. Everything comes from WITTMANN's own product development and production and therefore fits perfectly together", explains the Production Manager.

ROI in only a few months

Direct regrinding of sprue and scrap parts has some further advantages for the injection molder. First and foremost, the internal logistic system is simplified significantly without the need to transport scrap. What is more, renewed drying of hygroscopic materials can also be dispensed with if the granulate is directly processed again.

All in all, the return on investment has already been reached within just a few months.

Single-source industry 4.0 solution boosts operations

A savvy injection molder in the heart of U.S. automaking country is reaping great dividends by fully embracing Industry 4.0 technology to manufacture important parts – a commitment the company expects to be a significant advantage in drawing more business. BMI Injection Molding and Assembly of Chesterfield, Michigan, has invested heavily in cutting-edge digital manufacturing over the past two years – and they chose WITTMANN because their work cells are fully integrated, from injection molding machines, robots, to auxiliary equipment, software and controllers.

Thanks to the new integrated production cells, BMI has successfully positioned itself as a supplier of ISO FIX elements – such as those shown here.

BMI which has been in business for 30 years and employs a workforce of 50, began purchasing WITTMANN injection molding machines, robots, and auxiliary equipment in March of 2022 and added further machines optimized with WITTMANN's Industry 4.0 technology in the meanwhile.

Current products on BMI's manufacturing floor include SmartPower 240XL (270 US ton wide platen) servo-hydraulic injection molding machines, a MacroPower 450XL (500 US ton wide platen) large tonnage machine as well as five-axis robots with R9 controller.

WITTMANN's 240XL cell in particular "has really exceeded our expectations," enthuses Sam Holdsworth, BMI's director of operations and engineering. WITTMANN's all-in-one Industry 4.0 solutions "streamline set up, and process monitoring ensures delivery of quality finished goods" while also adding "an element of respect and organization to the manufacturing floor. In addition, the unique WITTMANN WiConnect! phone app gives our operators easy accessibility to friendly, knowledgeable WITTMANN team members and makes short work of any issues."

Automation and data drive efficiency

Producing parts for the automotive, medical and consumer goods industries, BMI has automated much of its part removal, with robots gently extracting parts from molds. This is particularly essential when producing "A"-surface automotive parts that require superior aesthetics. "Scratches or any part handling marring cannot be tolerated on these parts," says Holdsworth.

"They aren't brackets or under-the-hood components. When you sit in your car, you see these components – so for a human to only touch them at the very end of the production process is beneficial to achieving the final quality."

WITTMANN's Industry 4.0 work cells have helped put BMI on the map in producing ISO FIX bezels, Holdsworth explains. ISO FIX bezels feature pad printed images that identify child seat anchor points. BMI also produces seat adjustment handles (decorated and non-decorated), seat rail trim panels, body trim grommets and assorted interior, body and engine compartment fasteners.

"Some years ago, an ISO FIX standard was put in place requiring every tether point in a vehicle that accepts a child seat anchor be identified," Holdsworth explains. "When you were in your car and you could reach down between the seats and find this metal hoop, now that has to be identified and clearly visible. These bezels snap in certain areas, and that metal hoop is in the middle. We were initially decorating the parts with the words ISO FIX on them and eventually started molding them."

In the near future, BMI's five-axis robots will present the two parts (housing and cover) of the ISO FIX bezel to an assembly cell, where they will be snapped together, pad printed and off loaded to a conveyor that goes to an operator who inspects and packages each one.

BMI molds ISO FIX bezels in black, and a multitude of current automotive interior colors, says BMI Operations Manager Scott Lehman. WITTMANN's Industry 4.0 cell helps manage those colors. "We have WITTMANN Gravimax blenders that let us add colorant to the resin at prescribed ratios, because we have to adhere to a master color sample. That equipment is incorporated and works seamlessly within our 4.0 cell. If we didn't have the WITTMANN blenders, then we'd be adding colorant in different ways that is much less accurate."

WITTMANN's industry 4.0 advantage

Before purchasing WITTMANN equipment, BMI struggled through purchasing injection molding machines and auxiliary equipment from separate suppliers who were reluctant to talk to one another and provided only limited guidance in getting their respective equipment to work well together.

The Gravimax dosing units help with color management. They communicate directly with the injection molding machine and all other components of the production cell via Wittmann 4.0.

But when a WITTMANN truck packed with a digital manufacturing display pulled up to BMI, Holdsworth and his team began to see the benefits.

"We initially scoffed at the WITTMANN road show truck coming to our facility as a sales pitch," he said. "But when we saw what they demonstrated and heard what they had to say, we learned a lot about how WITTMANN can provide single-source solutions. Instead of having to get answers from different suppliers to any issues, we could deal with just one. The One-Stop-Shop is a true statement."

"It really does work, and the proof is when you walk out on the floor and you see all the green LEDs working in concert," he continued. "When one piece of equipment requires attention, it turns a different color indicating intervention is required. Once a process is developed for an application, the 4.0 technology provides us the ability through the machine interface to call up the program that automatically populates all WITTMANN equipment in the workcell with the correct process. If a certain piece of equipment is not correct for any reason the machine will not allow us to run without intervention from a lead technician or engineer. To have all WITTMANN equipment interfaces show up and the ability to control process parameters through the machine interface is a great thing – you can't say enough about it."

Another significant value BMI appreciates is WITTMANN's coordinated approach to onboarding customers, Holdsworth says: "As we moved through the molding work cell requirements, we had our WITTMANN local sales person and three WITTMANN experts (Machines, Robots and Auxiliaries) in our conference room, each responsible for making sure everything in the work cell works in concert."

Among the many benefits BMI reaps from WITTMANN's integrated Industry 4.0 is more consistent production and fewer bad parts.

"Parts per million rejections are always a key indicator with your customers, so we certainly use that as a selling point. The proof of the pudding is deliveries: Are you delivering parts on time, and are you meeting cost targets? The only way to do all of that is to be able to produce efficiently."

As BMI continues to hone its Industry 4.0 operations, Lehman says, "we're gathering data each and every minute, and we can establish baselines – whether it's a quarterly or an annual measuring stick. We go through those every week, so we've got a lot of good data we can use to our advantage down the road."

Ultimately, embracing WITTMANN and its fully integrated Industry 4.0 solutions "has been an educational process – and I don't think we've even nearly scratched the surface of what the capabilities are to help improve our operations," Lehman concludes.

Convinced by the One-Stop-Shop: Sam Holdsworth (left) and Scott Lehman (right).

The injection molding machines in the plant are equipped with WITTMANN linear robots.

Transparency in production

Transparency is an essential part of Bell's corporate philosophy, with the main emphasis not so much on the transparent plastic materials which take up the lion's share of the company's production, but rather on transparent communication directed towards consumers. For the Polish cosmetics manufacturer's commitment to sustainability is setting high standards. Only particularly energy-efficient machinery and equipment are admitted to the company's injection molding floor, such as the injection molding machines, robots and dryers from WITTMANN.

Visitors are already impressed by the building on their way from the car park to the reception. A lot of wood built into the facade, green roofs, and large old trees surrounding the premises. Here, the strong emphasis on sustainability and responsibility catches the eye at once.

We have arrived at Bell PPHU Kosmetyki in Józefów, 20 kilometers southeast of the Polish capital Warsaw, and are now sitting in the office of Production Manager Waldemar Gula. Through the window on his right, he enjoys an unobstructed view on nature, through the opposite window he keeps an eye on the injection molding floor, which at present contains 48 injection molding machines – all of which have come from the WITTMANN Group and are equipped with linear robots from WITTMANN. An extension is planned for the next few months, since the demand for cosmetic products from Bell is increasing rapidly.

PET looks like glass, but does not break when it falls down. Bell already relied on PET for the production of cosmetics packaging at a very early stage.

Output more than doubled with energy consumption unchanged

Everything started 35 years ago with the production of lipsticks. Now Bell covers the entire range of decorative cosmetics and delivers its products to more than 60 countries worldwide.

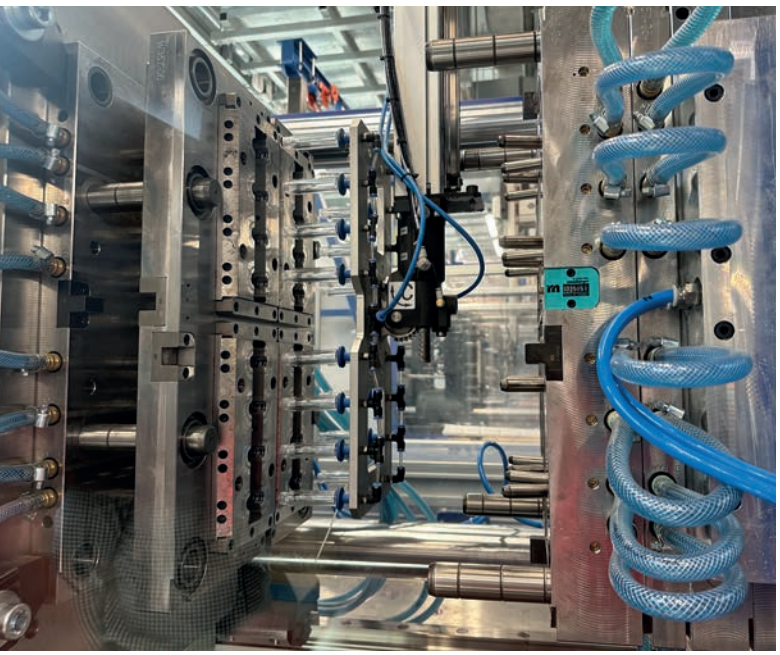
All primary packaging for make-up, eyeshadow, mascara etc. is produced in-house with a strong focus on sustainability. Servo-hydraulic SmartPower and all-electric EcoPower injection molding machines dominate the picture. The number one decision-making criterion for investments in new injection molding technology is energy efficiency. "With every new machine, the energy efficiency increases even further", Gula reports. "At the beginning of our efficiency boosting program, we were producing nine million parts per month. Now this has gone up to twenty million, but still our energy consumption in the injection molding shop has remained the same."

Gula attributes this success to the consistent use of injection molding technology from the WITTMANN Group. The machines from the EcoPower series come with highly dynamic servo motors to drive the main movements. Thanks to KERS, the deceleration energy of the drives is recovered and used within the machine, for example to supply the necessary voltage to the control system, or for barrel heating. "KERS stands for Kinetic Energy Recovery System", explains Bogdan Zabrzewski, Managing Director of the WITTMANN subsidiary in Poland. "With KERS, a further reduction of energy consumption by up to 5 per cent is possible."

The servo-hydraulic SmartPower machines from the WITTMANN Group also operate with KERS. In this series, the combination of fast-responding servo motors with powerful constant displacement pumps is the standard. For the injection molding process, this means maximum speed and precision of the machine's movements with simultaneous minimal energy consumption.

Specialized dryer solution for PETG

On the day of our visit, small, slender bottles produced inside a 16-cavity mold are running off the conveyor belt of an EcoPower 300 injection molding machine. Anyone unfamiliar with the material would take it for glass. In reality, it is PET. "PET looks like glass, but it does not break when it falls down", explains Gula, which is why this material is playing a more and more significant



Production inside a 16-cavity mold. All injection molding machines are equipped with linear robots for parts removal.

Waldemar Gula von Bell (center) with Bogdan Zabrzewski (left) and Piotr Matusiak (right) from WITTMANN BATTENFELD Polska.

part in cosmetics packaging. Twelve years ago, Bell was the pioneer in this field. "We were the first cosmetics producer to manufacture bottles for mascara and lip gloss from PET", says Gula.

Today, primarily PETG is processed, a glycol-modified variant offering a particularly high degree of transparency and impact strength, and simultaneously excellent processing attributes. With their standardized universal screws, the SmartPower and EcoPower machines deliver first-class injection molding results. "Only the drying process presents a special challenge for this material", Gula discloses. While normal PET is dried with temperatures around 160 °C, PETG requires significantly lower temperatures between 60° and 70 °C. "So, we have specially fitted the WITTMANN Drymax dryers for our customer Bell with a cooling device", reports Bogdan Zabrzewski. In this customized solution, it was of special importance for Bell that the cooling can be switched on or off as required. For the dryers are being used flexibly for other materials, too.

"The Drymax from WITTMANN has absolutely convinced us", says Gula. "We are reaching a dew point of -67 °C with it. This has not been achieved so far by any other dryer model." Zabrzewski explains the high performance of the Drymax dryer with the use of two desiccant cartridges. "The dryers deliver process air continuously, and drying air of constant high quality." Thanks to countercurrent regeneration, the dryer also stands out by its extremely energy-efficient operation

Machines with short delivery times

Bell's customer base is heterogeneous. In addition to long-standing customers, who place their orders well in advance and invariably for large quantities, there is a daily inflow of many short-term orders involving relatively small batch sizes. What is more, every national market sets different requirements, all of which has led to a very large number of active molds and frequent mold changes. "Elastic production" is the term used by Waldemar Gula to describe this great flexibility required from Bell every day.

Production planning is getting even more complex due to the innovation cycles becoming shorter and shorter. "Often a completely new packaging design emerges after just one year", Gula reports. Here, the in-house mold making shop helps the company to keep up with the trend in a fast and flexible way. But the cosmetics manufacturer also expects this flexibility from its suppliers. "Short delivery times are vital for us", emphasizes Gula, who has occasionally purchased a WITTMANN machine from existing stocks and once bought a SmartPower 300 directly from the booth at the Fakuma.

Mono-material packaging in vogue

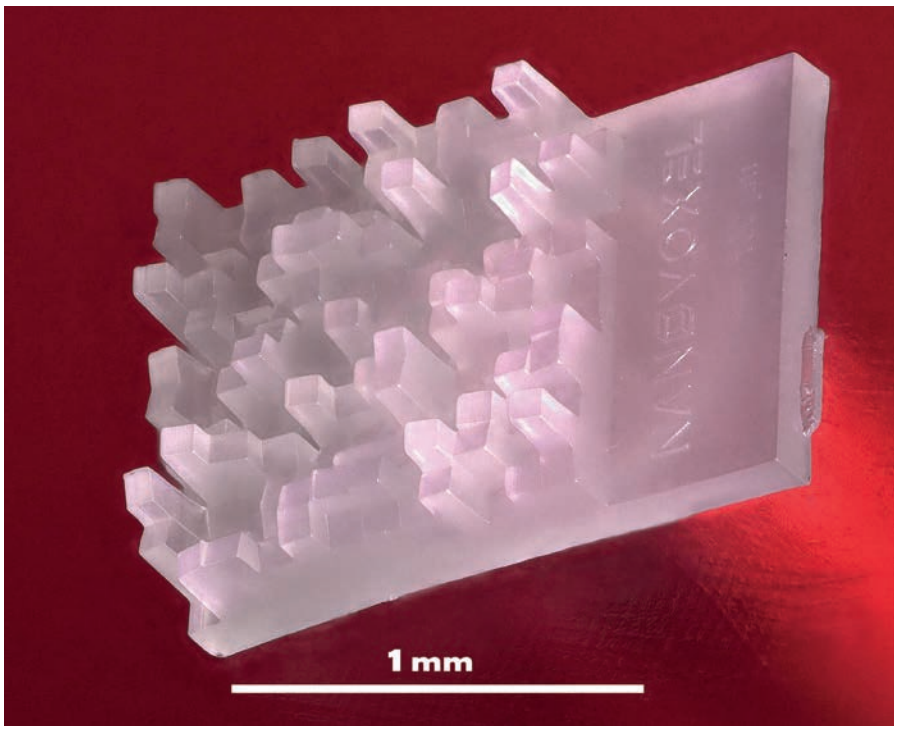
"We are able to fulfill all packaging wishes. Any form and any color – from transparent and matt-finished right up to high-gloss", says the Production Manager, and then adds that at present primarily high-gloss surfaces generated inside a mold are increasingly in demand. Here, sustainability is also an issue, since metalizing and chrome plating are more and more often dispensed with to protect the environment as well as the staff members. The current trend favors non-coated mono-material packaging, because it is easier to recycle.

"We bear a great ecological responsibility" emphasizes Waldemar Gula. "It is important for us to include the consumers' interests in all our decision-making". On its website, for example, Bell posts information about sustainable production and instructions for correct disposal of the packaging, so that the plastic materials will be returned to the cycle. Every piece of cosmetic packaging leaving the Bell plant in Józefów is provided with a QR code. This gives consumers very easy access to information about the packaging materials used and the correct way of disposal for recycling. "This is the only way for a circular economy to function", states Waldemar Gula, "by integrating the consumers into our network as part of the value chain."

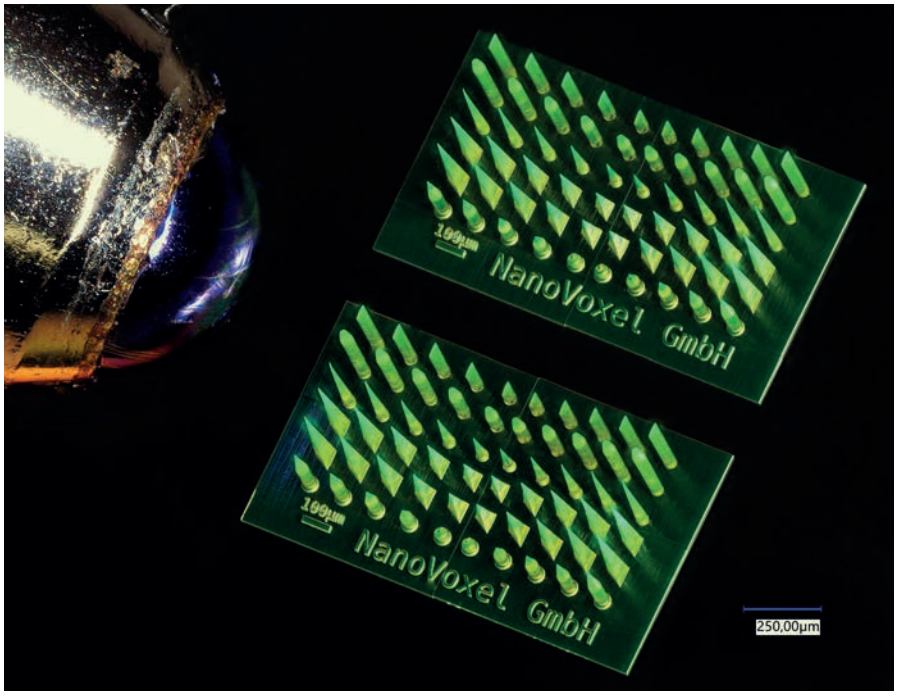
PETG places special demands on the drying process. The WITTMANN team has modified the Drymax dryers accordingly for their customer Bell.

Breakthrough in micro-manufacturing: Micro parts in just two weeks

Through the combination of the high precision 2PP 3D printing and the performance of the MicroPower injection molding machine from WITTMANN, the fabrication timeline of high precision micro-parts could be successfully reduced to two weeks. In addition to the extremely fast production of prototypes, completely new construction and design possibilities open up.



1: Such fine pillar structures in the order of 70 µm as in this acoustic diffuser cannot be realized with conventional methods of mold production.



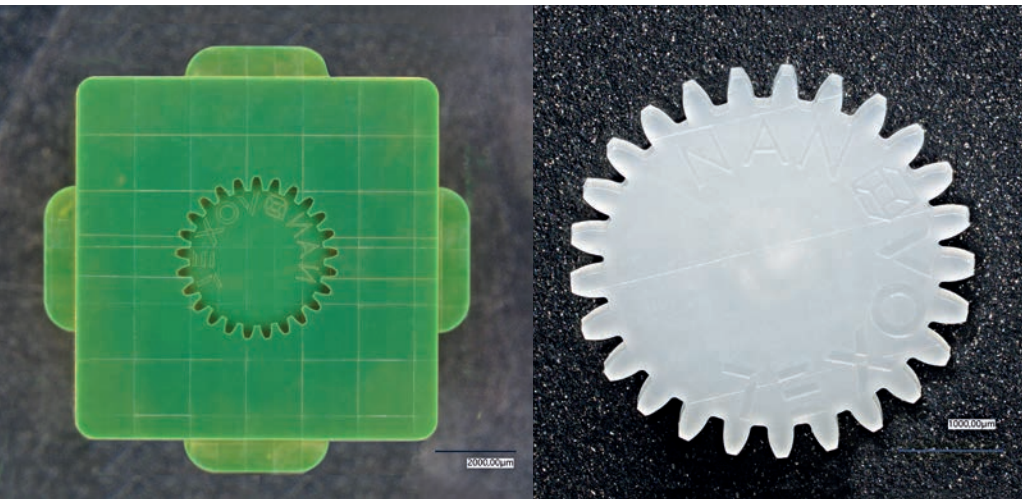
2: Array of micro-needles produced by 3D printing compared to a ballpoint pen tip.

High precision microparts are finding increasing relevance in different sectors including biomedical, consumer electronics, and many others. Most of the applications being developed require designs that require high precision, fast iterations, and challenge conventional design freedom.

For example, current manufacturing methods such as CNC, EDM, mask-lithography, and SLA 3D printing struggle to quickly or precisely produce parts like micro-diffusors for acoustic applications featuring 70 µm 3D details (**Picture 1**), micro-lenses with a roughness below 10 nm, micro-needles with 5 µm tips, micro-nozzles with apertures under 20 µm and micro-fluidic chips with specialized filters.

By combining highly developed additive manufacturing processes such as 2-photon polymerization 3D printing – 2PP 3D printing for short – and micro injection molding, the partner companies NanoVoxel and WITTMANN have managed to overcome the technological barriers in mold manufacturing for the first time. Both companies have a wealth of experience in the field of micro-technology.

Founded in Vienna in 2022, NanoVoxel has set itself the goal of revolutionizing the industry standard for micro-components.



3: Direct printed cavity insert (left) and POM molded 4 mm micro-gear (right). This cavity has been able to generate 50 parts with an accuracy of ± 5 µm.

The injection molding machine manufacturer BATTENFELD, which is now part of the WITTMANN Group, pioneered the development of micro injection molding machines around two decades ago. Today's MicroPower injection molding cell from WITTMANN, with a clamping force of 15 tons, is tailor-made for the production of precision parts in the micro range. Thanks to its high modularity and extremely space-saving design, it offers considerable economic advantages.

Despite the progress in mold making, the bottleneck in micro-part production persisted by their injection cavities, resulting in prolonged lead times of up to 20 weeks. Clients reluctantly accept larger tolerances (± 30 µm), but there's a growing need for shorter lead times, and smaller features, especially in prototype development. The time-consuming precision mold production lingers as the chief bottleneck.

The breakthrough in precision combined with economic efficiency has been achieved in recent years with the 2-photon printer of UpNano, a start-up also based in Vienna and a partner of NanoVoxel. This printer is based on the principle of non-linear absorption of photons, called two-photon polymerization (2PP). A femtosecond laser emits a narrowly focused beam to excite a photosensitive resin. The scanner unit moves the laser beam via Galvano mirrors and lens systems to cure the resin. Like SLA/DLP 3D printing, when the light is absorbed, it triggers a chemical reaction in the resin, causing it to polymerize and solidify at the focal point of the laser beam. However, in a deviation from established 3D printing technologies, 2PP achieves full control of z-dimension polymerization, so holes and cavities are precise and round. The 2PP printing process offers unparalleled precision and resolution to most other manufacturing techniques, enabling the creation of complex 3D microstructures with sub-micron accuracy, even down to the nanometer range. This makes it ideal for applications requiring particularly intricate detail with high surface quality. A variety of photosensitive resins are available for 2PP printing, including photopolymers and hybrid materials. These materials can be tailored to specific applications and offer a wide range of mechanical, optical, and chemical properties.

From prototype to mass production

Using 2PP printers, micro parts can be printed within hours from a 3D-CAD file with a precision that cannot be achieved by conventional toolmakers, even with the most advanced machinery. Tolerances below 1 µm, structures down to 200 nm, and surface finishes with an average surface roughness better than 10 nm can be produced quickly and economically with this advanced additive manufacturing. Geometries that cannot be produced through injection molding, due to undercuts for example, can be produced quickly with 3D printing. **Picture 2** shows an example of 2PP printed microneedle prototypes, emphasizing sharp edges and micro-hollow structures.

Provisionally, the disadvantage of this technique is its capacity for high volume production, making it uneconomical for parts larger than a few mm. The limitations of both micro-molding and micro 3D printing pose the question: What changes can expedite lead times, keep high precision, and still maintain high productivity?

To answer this question NanoVoxel combines the best of both worlds, establishing the union of 2PP printing with micro-injection molding its core business. By using 2PP 3D-printing to quickly produce a high-precision mold for the micro-injection, it replicates the precision and the resolution of 2PP in molded micro-parts with highest efficiency. **Picture 3** shows an example of a micro-gear molded from one of these printed cavities.

NanoVoxel aims to become a one-stop service platform offering flexible and multiple manufacturing solutions and strives to become one of the most innovative companies in the micro manufacturing world. NanoVoxel's multi-disciplinary team of experts combine these different technologies to offer prototypes through to high-volume production as a service provider. This remarkable accomplishment compresses the timeline for structure fabrication into an incredible two-week span.

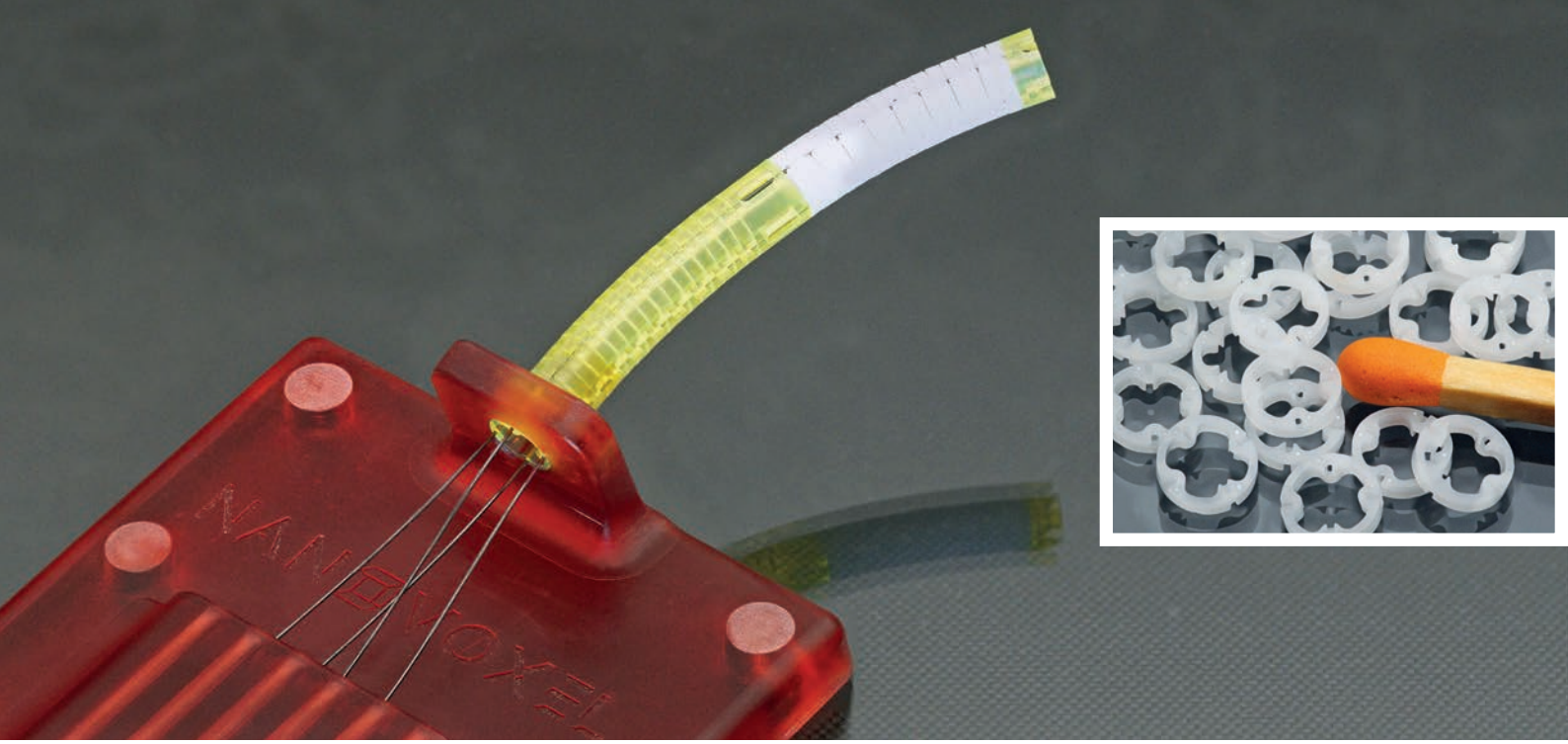
MicroPower achieves a stable process with the shortest cycle times

NanoVoxel has since achieved a breakthrough in the molding of micro-parts that was previously impossible to fulfil, enabling the molding of small, detailed structures with high accuracy and repeatability within tolerances of a few microns. In addition, high-precision 2PP 3D-printing to create mold cavities enables larger parts with single-digit micron features, which would otherwise be time-consuming, expensive, or impossible to produce.

An example of NanoVoxel's service is the development and manufacturing of an endoscope for the aiEndoscope company (**Picture 4**): the segments of the endoscope have been initially printed in different design variations at the prototyping stage for geometrical tests and optimization. Upon design validation from the customer, the quickly molded parts were produced and enabled functional and mechanical testing. All the manufacturing process and iterations on this project were completed within 5 weeks.

The capabilities of combining different processes including mastering, casting, and sintering, allow NanoVoxel to create molds with the highest precision, not only from 3D printing materials but also with more robust materials like glass, ceramics, and metals.

To leverage the highest precision of the molds, NanoVoxel uses the MicroPower 15 t (**Picture 5**) from WITTMANN. With a clamping force of 15 tons, the machines of the MicroPower series are designed for the economical production of exceedingly small and micro parts with maximum precision and repeat accuracy. A two-stage screw-piston injection unit with a shot volume >>



4: End arm of a prototype endoscope developed for the company aiEndoscopic. The yellow translucent section is made of 3D printed segments, while the white ones (small picture) are POM molded segments.

of 1.2 to 6.0 cm3 injects a thermally homogeneous compound. This makes it possible to produce parts with outstanding precision, extremely stable production, and exceptionally short cycle times. The distinctive design of the machine allows the injection plunger to nearly reach the parting line of the mold. This reduces the mass cushion to a minimum. In addition, the standard version of the machine is already ideally suited for production under clean room conditions: it is designed with an enclosed housing cell. All drive modules of the all-electric drive system, including all mechanical components, are encapsulated in easy-to-clean housings.

Printing the finest structures on larger parts

The combination of 2PP printing and micro injection molding is not limited to only the high precision rapid tooling process. NanoVoxel brings a significant addition to the micromanufacturing industry with its capacity to 2PP print directly on parts of different materials manufactured with other processes. This print can be made onto many materials including glass, ceramics, carbon substrates, metals, and plastics.

This enables customers to imprint detailed functional features directly onto bulky and larger parts obtained from more efficient processes. Initial applications have been successfully applied in the microfluidics world, where NanoVoxel printed unmoldable features into commercial chips, using their advanced printing process only where needed.

This innovation opens up new design possibilities for designers and engineers. It also offers a creative, efficient and yet simple approach to production for unconventional component geometries.

5: The MicroPower injection molding machine was developed specifically for the economical production of extremely small parts with the highest possible precision and repeat accuracy.

Probably the smallest business card in the world

The small red plates measure just 8.5 mm square and yet they can fit a complete world map with the full addresses of all WITTMANN production plants worldwide. At the Fakuma and Compamed trade fairs, they were produced live on a MicroPower machine in a 4-cavity mold produced using 2PP 3D printing. The exhibit proved to be a magnet for visitors in both Friedrichshafen and Düsseldorf in 2024.

The next chance to see the exhibit live in action will be at **Plastimagen 2025** from March 11 to 14 in Mexico City.

Workshops: Sustainable production with Airmold

Sharing their knowledge and experience about internal gas pressure technology with injection molders (fom left to right): Stefan Böllinghaus (WITTMANN), Christoph Mussauer (SKZ), Ulrich Schätzlein (SKZ) und Domenico Scavello (WITTMANN).

Material and energy saving is the order of the day. This trend moves gas-assisted injection molding into the focus. In two-day workshops, WITTMANN and the German Kunststoff-Zentrum SKZ will demonstrate the opportunities for more sustainability provided by gas pressure technology. For 2025, two workshops are planned.

In internal gas pressure injection molding, nitrogen is injected into the cavity partly or completely filled with plastic melt, generating a hollow structure inside the part. In this way, raw material is saved and the weight of the molded parts is reduced. Yet the parts still come with a faultless surface, since the nitrogen gas takes over the task of holding pressure and counteracts shrinkage of the parts from inside. The range of applications is enormous. From car interiors and sports equipment right down to beverage crates, internal gas pressure technology supports processors in their efforts to combine low material consumption with high part quality as well as energy and cost efficiency.

Including the production process in design development

The workshops about internal gas pressure injection molding jointly organized by WITTMANN and SKZ are aimed at plastics experts wishing either to try out internal gas pressure technology for the first time or to optimize already existing gas-assisted processes. "In addition to plastics processors and mold makers, we are making a special point of inviting product designers and engineers as well, since the savings potential can be exploited most fully if the production process is already taken into account at the product development stage", emphasizes Domenico Scavello, Regional Sales Manager and Airmould specialist at the WITTMANN Group.

With Airmould, WITTMANN has developed its own patented internal gas pressure injection molding system, which can be combined with all types and brands of injection molding machines via a Euromap 62 interface. For the nitrogen supply, WITTMANN also offers a highly efficient solution from its own development and production.

"The savings potential can be exploited most fully if Airmould is already taken into account at the product development stage."

Domenico Scavello, WITTMANN

The participants of the workshops will benefit from the extensive knowledge and experience of the organizers. The experts from WITTMANN and SKZ will take time to answer the individual questions of participants, who will be welcome to bring parts and drawings of parts to the workshops. "We wish that all participants can take home some tips to be implemented quickly in their daily practice ", says Scavello.

Many examples from practice

To this end, the workshops will combine theory with extensive practice. Following a thorough introduction to the advantages, opportunities and design guidelines of internal gas pressure technology, various application examples will be discussed, before the participants will finally be led to the injection molding machine for live experiments. Two products with completely different requirements will be manufactured. Firstly, an automotive component with a complex geometry, and secondly, a clothes hanger.

WITTMANN has placed an injection molding machine with the Airmould technology package at the disposal of SKZ for the workshops and further training and development programs.

Airmold units from WITTMANN are modularly designed for use on injection molding machines of various types and brands.

Register now!

Workshops in 2025:

- 14 to 15 May
- 29 to 30 October

Location: SKZ in Würzburg, Germany
Language: German
Cost: 1395 Euro
Further information and registration:

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