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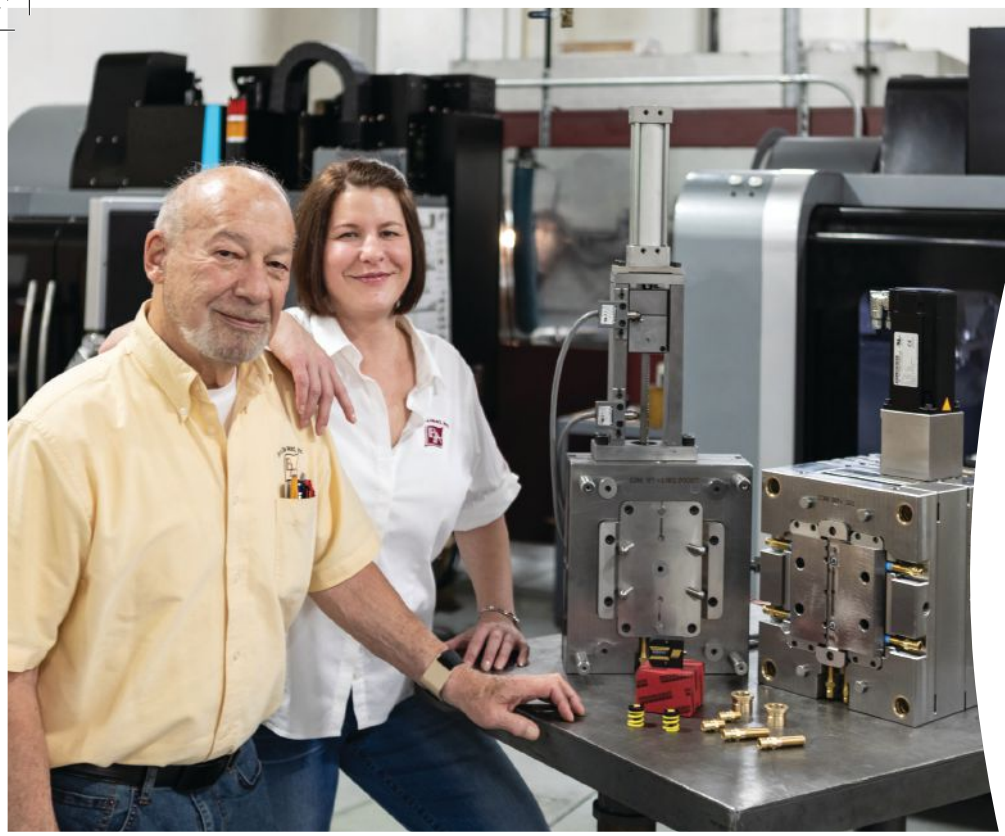

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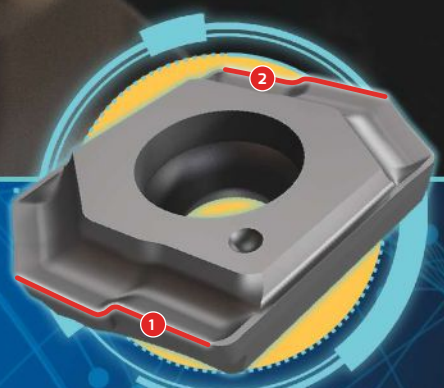

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February 2019 Volume 22 / Number 2

Features

Departments

ON THE COVER

Cover photo courtesy of **Reichle Technologiezentrum**. This month's cover shows a laser-textured mold surface sample produced using a pulsed fiber laser ablation machine. As soon as the laser beam hits the surface, it vaporizes the material with an accuracy of up to 1 micron. One advantage of a laser-textured surface is reproducibility because the data is consistent, transparent and always available. The error factors are very small, and the process is 100-percent repeatable. See related feature on **page 14**.

Images courtesy of (left to right) Tri-Par Mold, Verisurf and Mold Trax.

VIDEO ACCESS

5 TRICKS OF THE TRADE
Great Tips from This Issue

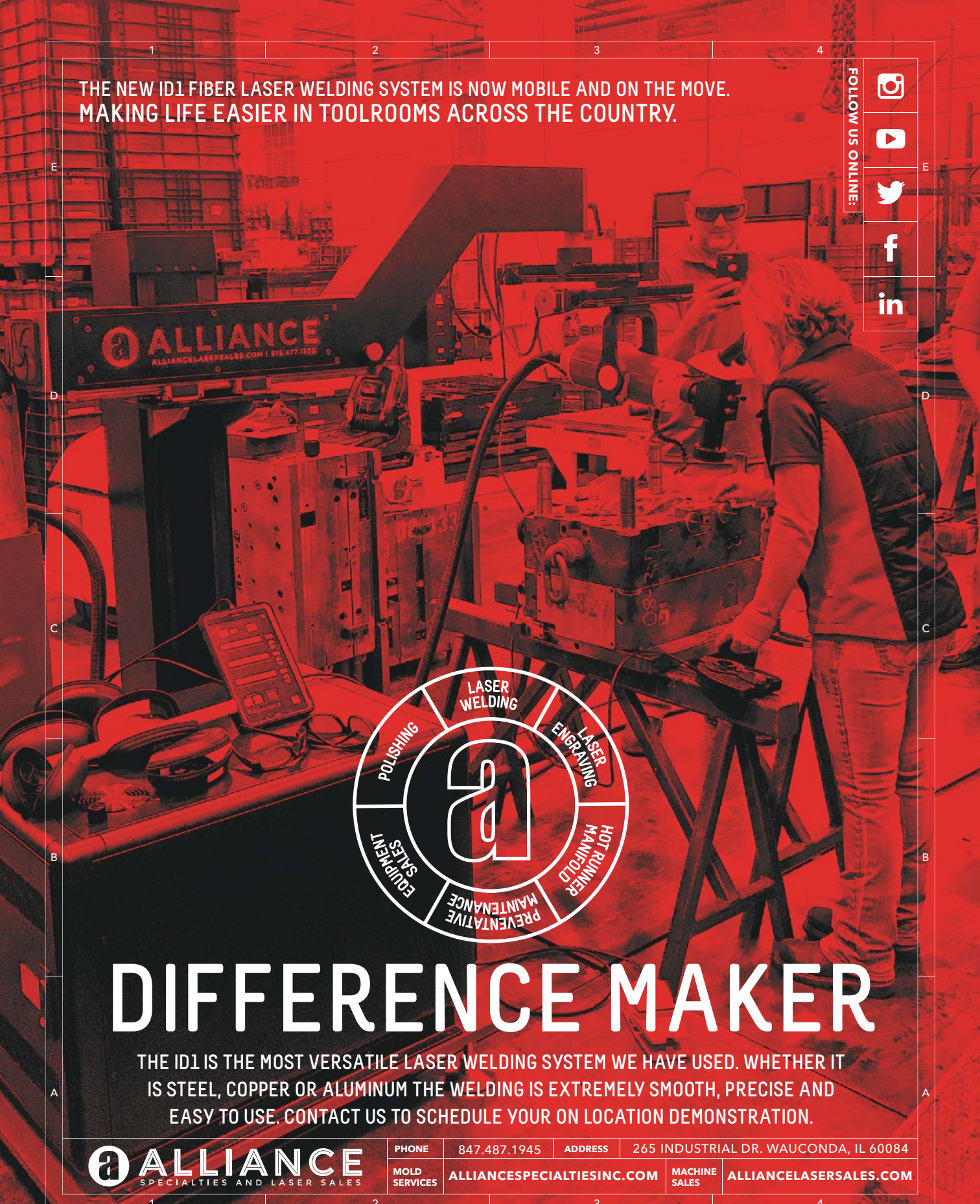
1. Texture Tidbits
A big advantage is developing design proposals long before tooling is in the manufacturing process, and the customer sees in advance how the surface texture of his product will look. **PG. 14.**

2. Take a Lesson
As a rule of thumb, low-run components produced using a 3D-printed mold insert will be less expensive on a per-part basis. **PG. 24.**

3. Measuring Up
Review and analyze the profit margin historical data in each project category. Then establish a targeted profit margin for each, thereby establishing a measurable. **PG. 28.**

4. Stay Safe
Small- to mid-size manufacturers must act as a human firewall, implement secure communication methods, develop a sophisticated password strategy, use a secure backup plan and educate employees. **PG. 32.**

5. Make Room
Diffusion bonding removes the need for end plugs, eliminating the risk of leakage and simplifying the entire channel layout, which provides more space for bolt locations. **PG. 48.**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Disruption or Inspiration?

The new normal in mold manufacturing is change, and with change comes challenges. The question is, do you view these challenges as disruption or inspiration? The mold manufacturers I know would answer the latter. They serve as the inspiration to develop new solutions.

These challenges are also the inspiration behind what the *MoldMaking Technology* team will cover in 2019, which includes providing a snapshot of the current status of each challenge as well as strategies to constructively face each one. These challenges range from technology issues, like additive manufacturing, automation, and Industry 4.0, to business issues such as tariffs and trade, cybersecurity and workforce development.

One of the most talked-about challenges is workforce development. The core competency of workers is going to be very different in five years because of the changing landscape of manufacturing's workforce, and to help us tackle this challenge, *MMT* has invited Marion Wells, a talent development consultant and partner in Human Asset Management (HAM) to serve on our Editorial Advisory Board. Powered by Gardner Intelligence, we've also partnered with Marion to launch a project that will provide another perspective on how to manage the ongoing skilled-labor shortage.

The project will kick off with a survey to understand the current state of the industry's workforce strengths and challenges, effective apprenticeships/skills training, and strategies and programs. The project will also include a call to engage with industry and the community in finding, training and retaining a diverse next-generation workforce. The culmination of this project will be an article series in *MMT* and a panel presentation at Amerimold on June 12th, which will reveal the results of the survey and share real-world solutions from several mold-builder survey participants.

Marion works with companies that aspire to achieve organizational results through the development of their human capital. She has more than 20 years of business solution experience in manufacturing and the automotive industry, which gives her deep credibility and understanding of how businesses function. She works with leaders who are committed to balancing the reality of industry and organizational challenges with the need to effectively lead others. While examining these often conflicting priorities, Marion helps her clients gain clarity about what is important and align their decisions and behaviors accordingly.

HAM believes "people are an organization's greatest asset," and so does *MMT*. With that in mind, we are excited to get to know some of you a little deeper through this project with the hopes of providing content that better meets your needs moving forward. MMT

Christina Fuges

Christina M. Fuges
Editorial Director

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THIS MONTH ON moldmakingtechnology.com

VIDEO: How Does Thermal Imaging Communicate Thermal Dynamics in a Hot Runner System?

MoldMaking Technology Editorial Director Christina Fuges chats with Rich Oles president of Alba Enterprises about thermal imaging and how it communicates thermal dynamics in a hot runner system, how it picks up problems that other approaches cannot pick up at all or not as quickly, and how it will advance in the future.
short.moldmakingtechnology.com/albavideo

BLOG: The USMCA Trade Agreement: Impact and Next Steps for Moldmakers

The U.S.-Mexico-Canada trade agreement (USMCA), aka the "new NAFTA" should benefit the majority of North American molders and mold builders.
short.moldmakingtechnology.com/usmcamoser

EVENTS: Molding 2019

Molding 2019 on March 19-21 in Indianapolis, Indiana, brings global leaders and innovators in injection molding together under one roof in the world's premier technical conference on this technology.
short.moldmakingtechnology.com/molding19

PODCAST: Interview with Paragon D&E

"It's people that make the difference," is written on the wall in the conference room where we sit for an *MMT*/Manufacturing Alliance Podcast with Greg Eidenberger of Paragon D&E.
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Putting 3D Printing to Work

By Ryan Katen

Micro Mold and Plastikos together employ more than 100 employees across 75,000 square feet of engineering, design and manufacturing space to provide moldmaking and custom injection molding for challenging tight-tolerance plastic injection-molded parts. Both companies have invested more than $400,000 in technologies and processes related to 3D printing and reverse engineering over the last three years.

Our use of 3D printing varies depending on the specific application at hand. For example, in our molding operation, we use our 3D printer (dimensions: 19.9" by 13.31" by 27.09" with a printing plate 7.8" by 8.5" by 11.8") to develop various components and fixtures that we use for product handling and cavity separation, such as end-of-arm-tooling grippers. However, this work is limited to the tolerances 3D printing can achieve. We also use 3D printing to streamline up-front product development and support for our OEM customers. For example, reverse engineering existing product designs to identify further opportunities to reduce wall thickness, simplify part design and improve cycle time.

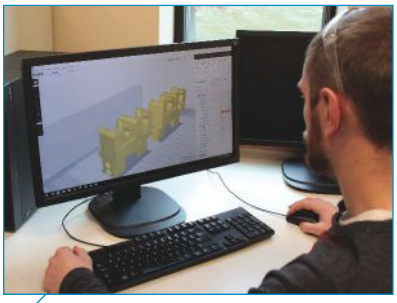

Photo courtesy of Micro Mold.

Micro Mold Tooling Engineer Matt Garing uses 3D printing software.

We have experienced several major advantages of 3D printing over traditional manufacturing techniques like machining. For example, our engineers can customize a fixture for end-of-arm tooling in a fraction of the time and cost it would take using traditional manufacturing techniques. From there, these custom fixtures can be used within our manufacturing cell to enhance product handling, cavity separation and sorting a potential non-conformance.

We recently created an automation engineering position within Plastikos to focus on expanding the company's use of 3D-printed techniques within manufacturing. It will also identify opportunities to improve product handling and in-line product containment and inspection.

From a tooling standpoint at Micro Mold, we are researching laser sintering, which has the potential to produce cavity blocks, and mold and part geometry for applications where conformal cooling is warranted.

We also are looking for third-party equipment reviews that test and compare the capabilities of the various technologies. We are not currently focusing on one additive technology. Instead, we continue to focus on staying abreast of the various technologies in the market and their capabilities to ensure that we are utilizing the technologies where applicable. MMT

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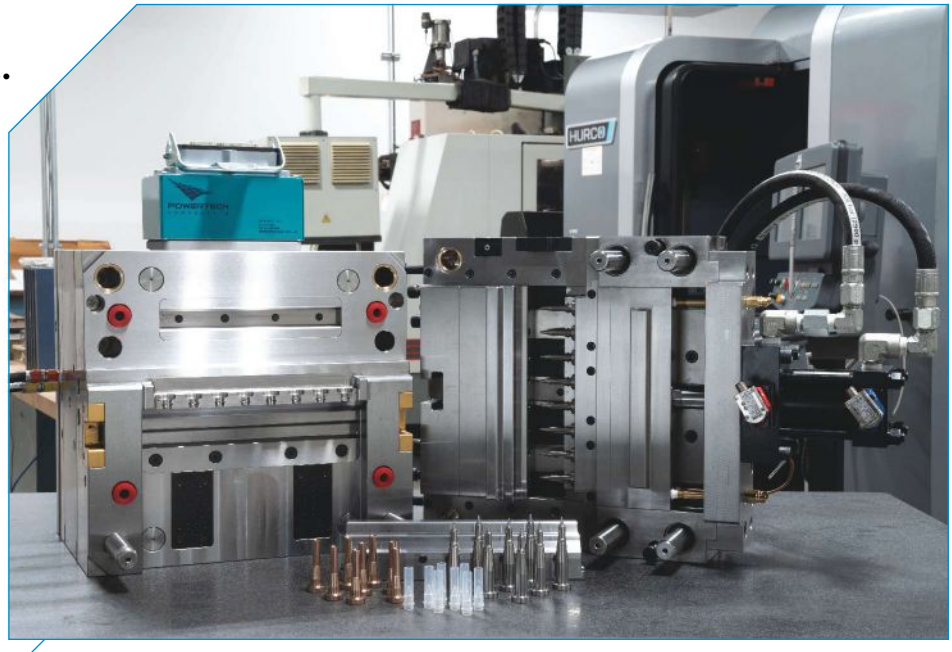
* Performance and longevity are dependent, in part, on the application and the system configuration.

VIDEO Access the related video under the Videos tab at *MMT* online.

A Conversation with ...

Tri-Par Die and Mold Corp.



Images courtesy of Tri-Par Die and Mold Corp.

Tri-Par Die and Mold Corp. manufactures molds and full turnkey production cells for customers. The mold shown here was built by Tri-Par for a specific molding machine that a customer shipped to Tri-Par's plant. The mold was set up in the machine and the entire cell and mold were debugged, qualified and shipped back to the customer's plant for production.

Where does Tri-Par excel regarding its mold engineering and building expertise?

David Plocinski, General Manager: We build many molds for parts made with highly-engineered materials like high-temp LCP (liquid crystal polymer) materials, glass-filled nylons and high-melt-flow resins. We run a lot of glass-filled materials in our molding department, so we continually work to ensure that the molds can withstand resins that contain up to 43 percent glass in them because these materials are extremely abrasive and can cause extensive mold wear if not built and maintained properly.

We build most of our new molds for the microbiology research industry. It's not medical; it's more for nonmedical applications. An example would be small vials and caps for DNA testing. The challenge with these types of molds is that the parts can have extremely thin walls, as thin as 0.007 inch to 0.008 inch wall thickness, molded using high-flow materials (usually propylene—clarified, nucleated, anti-stat, higher end types of propylene). These types of propylene flow very easily and can flash very easily, so our tolerances on the molds must be extremely tight and for good reason. If you were doing DNA testing, for example, rubber gloves are required to avoid contaminating the samples. But if the vial has flash or hard gates on it, and the gloves get cuts on them, you risk contamination and any number of other issues. So, gating is critical, and we've used straight hot-runner systems, valve-gate systems, even three-plate molds to work around and resolve the various challenges our customers' part designs

> Our team puts its vast knowledge of plastic materials, production injection molding, heat profiles and more into every project to produce a mold that provides great value to the customer.

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- Founded in 1960 by Ray Polcyn, Art Fraske and Henry Kugler. Three partners, hence the company name: Tri-Par. The current owner, Bill Plocinski, started in the trade at Tri-Par as an apprentice moldmaker in 1963.
- In 1978, after working for other moldmaking companies, Bill Plocinski was invited by Ray Polcyn to return and buy into Tri-Par when other partners retired. Plocinski bought the company outright in 1988.
- Industries served include medical, water filtration, power tools, automotive, appliances, lighting, consumer products and other applications.
- The company also offers injection molding services ranging between 50 tons and 720 tons.
- ISO 9001: 2015 certified for quality management.

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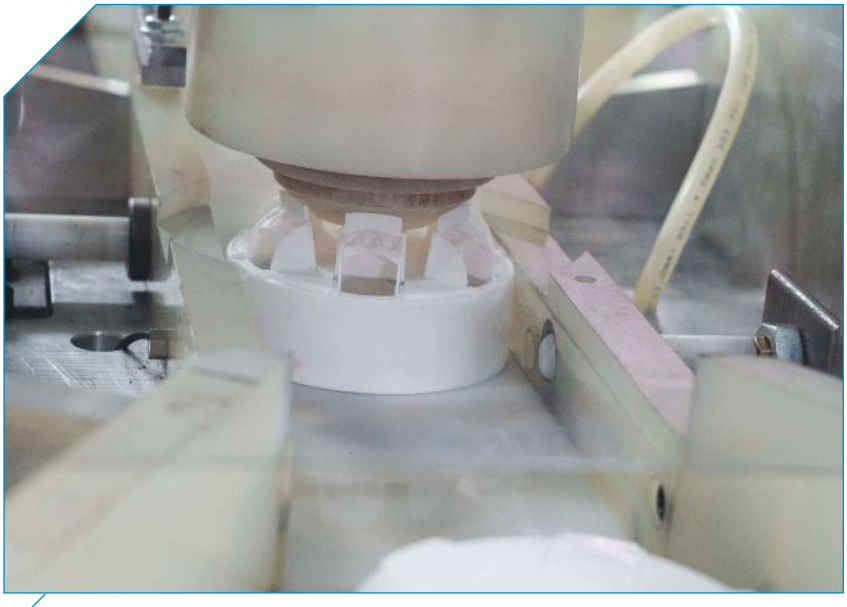
present to us. We have become very well versed in engineering these molds; our team puts its vast knowledge of plastic materials, production injection molding, heat profiles and more into every project to produce a mold that provides great value to the customer. High productivity molds with minimal downtime.

We also get creative with our venting and getting the air out to prevent knit lines or holes in the bottoms of the vial wells. For example, we recently built a mold for a small vial. During sampling, we saw that it was trapping air right at the end of the vial well and material was not filling properly. Based on our team's experience with similar issues, we put a vent pin inside of the core pin. The vent pin was only about 0.060 inch in diameter; we wired a hole so that the vent pin could be installed and allow the trapped air to vent out. Then we designed it so that it was a moving vent, which made it self-cleaning and it will not clog up. It seems like such a simple solution, but it solved a crucial problem for our customer.



An up-close view of an automated post-molding secondary operation for a cap being molded at Tri-Par Die and Mold illustrates the company's expertise in building automation to markedly reduce the need for operators to perform such secondary processes manually. Tri-Par built the mold for this cap and designed and built the automation as an investment in efficiency and continuous improvement.

How are you able to leverage your moldmaking team's knowledge and expertise across Tri-Par's operations?

Plocinski: The mold makers in our tool room are not just mold builders. Yes, they build molds, and they can repair molds. But they are also machinists and know quite a lot about hydraulics and pneumatics because of the nature of our industry. We also have experience with unscrewing molds and have worked with servo systems, and so we can leverage all that knowledge into designing and building automation for the molding side of the business. These systems are very simple yet highly productive automation solutions.

I like the K.I.S.S. method, keep it simple. We've been able to build some great pieces of automation for extremely low cost that have provided

us extraordinary returns on investment. Previously, in some instances, we would have a machine operator sitting at a molding press 100 percent of the time performing a post molded secondary operation while the mold was running. Now, using simple automation, they interact with the molding cell 5 percent to 10 percent of the time, swapping out empty boxes for boxes filled with parts. They weigh count each box, put it on a skid and move on to tend to other machines. Our molding group and tooling group worked together and came up with a design that ultimately improves our bottom line. Even though it's the customer's mold and part, I will invest in automation or mold enhancements if it makes sense. It's beneficial for our customers and Tri-Par.

> We build many molds for parts made with highly-engineered materials like high-temp LCP (liquid crystal polymer) materials, glass-filled nylons and high-melt-flow resins.

I believe the way we leverage our experience, knowledge base, and continuous improvement strategies into mold building and production injection molding provides great value to our customers. This has been especially effective since moving three years ago into a new, larger, 60,000-square-foot facility, which allowed us to consolidate our tooling and molding operations under one roof. This allows our mold makers to interact with the molding department and see first-hand how well our molds are performing in production. This firsthand learning is priceless in terms of applying lessons learned to future mold builds. We have 24 molding machines ranging from 50 tons all the way up to 720 tons, running three shifts 24 hours a day, six days a week. We have full tool-room capabilities, including high-speed CNCs, sinker EDMs, grinders and other equipment.

What does the future look like for Tri-Par? What growth strategies are in place?

Plocinski: We have grown, and we believe that growth will continue. We're bringing in more customers from different industries, and we have upgraded equipment, including purchasing a new Charmilles sinker EDM and new Hurco high-speed machining centers. We're looking to expand by leveraging our knowledge and expertise into different industries and markets including building molds for more complex threaded parts and getting back into molds for automotive lighting.

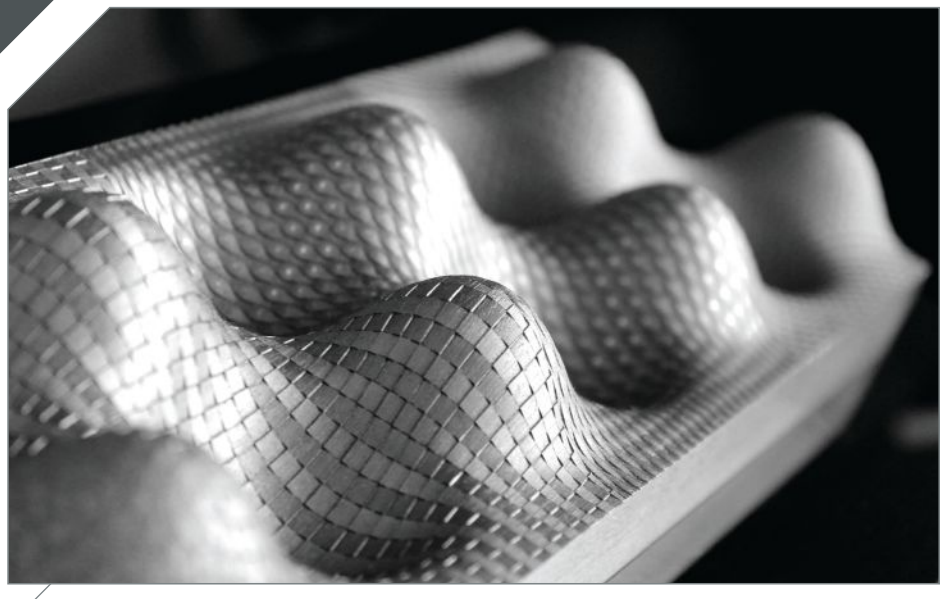
One exciting project that we did recently is a full, turnkey cell for a customer whereby the customer drop-shipped the molding machine to us and had us build the mold for that machine. When the mold was completed, we installed the molding machine, set up the mold and debugged the entire cell in our facility. Then the customer came in; we qualified the mold and molding cell. Once approved, the entire cell including the molding machine and mold were shipped to California for installation and production. It isn't the first time we have done this. The same customer drop-shipped a two-shot molding machine to us and had us build three two-shot molds. This cell included the two-shot molding machine with servo rotary platens. Again, we debugged and qualified all three two shot molds and molding cell, then shipped the machine, auxiliary equipment and all three molds to the customer's plant. With a larger facility, we can provide more and larger turnkey solutions. MMT

By Barbara Schulz

VIDEO Access the related video under the Videos tab at *MMT* online.

Higher-Level Laser Mold Texturing

Eroded, sandblasted and chemically-etched mold textures are now 100-percent lasered at this Germany-based service provider.



Images courtesy of Reichle Technologiezentrum.

A great advantage of a laser-textured surface is reproducibility because the data is consistent, transparent and always available. The error factors are very small, and the process is 100-percent repeatable.

Design impacts how a customer perceives a car and laser texturing influences that design. The process offers limitless design possibilities, eliminates manual work, digitalizes processes, cuts development and delivery times and creates a comprehensive end-user experience.

"We dress the naked part," is how Marco Reichle describes what Reichle Technologiezentrum does. Located in the Kirchheim unter Teck near Stuttgart, Germany, this one-stop service provider for tool and moldmakers specializes in laser welding, mold repair, engraving and polishing. The company also offers laser texturing, in-mold coating and design development.

Since investing in the first laser ablation machine from GF AgieCharmilles in 2012, the 29-year-old entrepreneur, who runs the 80-men strong company together with his father Volker and sister Marina, has invested in 13 laser machines. This investment is on top of 12 machines in its new China subsidiary. All of this new technology replaces the traditional chemical etching process they use to texturize and sandblast molds for gloss level adjustments.

"It's important to invest in innovative concepts to meet the changing requirements of the automotive industry, where the design will be more diverse in the coming age of autonomous, electric vehicles," Reichle says. "As design becomes less about technical specifications for such things as the engine and chassis, car manufacturers will be challenged to design a comprehensive user experience. For example, the part surface the end user will see and touch will play a key role in deciding which automobile brands survive into the future."

A Real Alternative to Etching

Almost any design option or requirement on haptics and optics can be realized with laser texturing. Examples would include glossy, grained, dull, smooth, structured or rough-shaded textures, and simply elegant or just functional textures. The process is reliable and repeatable since manual work is eliminated and all structures are digitally created and reproduced on the laser.

"Gone are the days when you had to rely on laborious and error-prone manual work," Reichle says. "This type of surface treatment offers a real alternative to conventional etching, blasting or erosion processes and makes surfaces possible in injection-molded parts that were previously not feasible."

"We can set the gloss level variably within the grain, and it will stay constant over the entire production cycle, largely without wear," Reichle says. "Amorphous plastics such as PC-ABS, ASA, POM, etc. shine much stronger than, for example, PP. However, according to the current trend, a high-quality impression only results from matt gloss levels in plastic parts. With special microstructures that we lay over any grain, we can continuously adjust the gloss level. This makes it child's play to achieve a low degree of gloss level (0.5-2.0 GE) even in amorphous plastics, identical to PP."

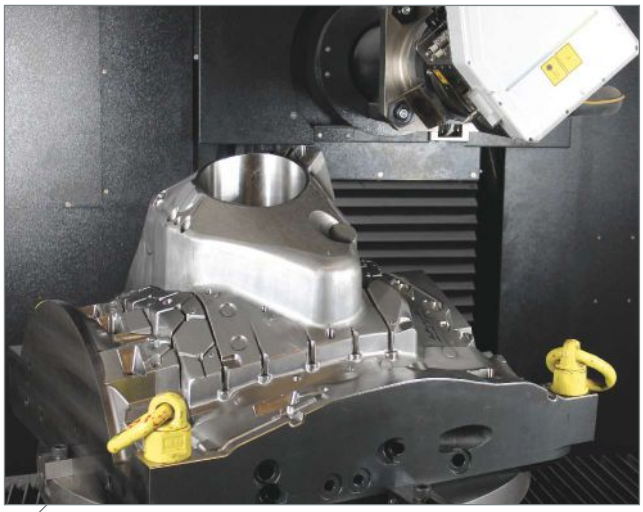
Laser technology can also help shops realize scratch-resistant structures, which are becoming increasingly popular in the automotive industry. For example, stressed areas, such as spoilers or door sills, that are designed to be water-repellent, and where very dull surfaces are designed to reduce reflections from the dashboard to the windshield.

Reichle, who works for and with a diverse range of industries but increasingly with automotive OEMs, takes laser texturing to a high level. He says this requires a lot of dedication, experience, investment in the right equipment, experienced staff and a team of designers who design the most advanced textures for their customers.

Cutting-Edge Design

"The most current trend is fading structures, which become less prominent towards the edges and can only be digitally designed and laser textured, which is what our four designers are mainly working on right now," Reichle says. "We created our in-house design department in 2017, which is what sets us apart from the competition. Without good in-house product designers, who have a particular liking for details, you should not even consider investing in a laser texturing machine. We work closely with automotive OEMs, have regular meetings and help them to reduce a car's production costs by replacing expensive interior materials. We also work to differentiate so-called "carry-over parts" (which are used in medium-sized and expensive cars to reduce costs) by creating different surface structures that vary in gloss, look and feel. However, whether we design a surface for a lipstick, a high-pressure cleaner or rear spoiler, we invest up to 100 hours in creating the perfect surface. We concentrate on the surface and nothing else."

> We concentrate on the surface and nothing else.



Since investing in the first laser ablation machine from GF AgieCharmilles in 2012, Reichle has invested in 13 laser machines to replace the traditional chemical etching process used to texturize and sandblast molds for gloss level adjustments.

If, for instance, a customer wants to recreate a certain leather grain structure, the design team scans the original sample and optimizes the resulting greyscale bitmaps. The designers work on a micron-level to create complex contours with technical or decorative digital structures. The resulting greyscale bitmap is high-res with a size of many gigabytes, Reichle explains. The three- or five-axis laser system converts each greyscale to height information. If a grain structure is 50 microns deep, the laser machines 40 to 50 different greyscales to achieve the desired structure.

"In comparison, manual etching is limited to three or four detail stages the user can control, while the rest of the structure is created randomly by the acid. The designers can also design the texture exactly. For example, if they locate the radius on or next to an edge, they can precisely separate the polished areas from the textured ones," Reichle says.

After the design stage, the mapping process starts. A special mapping software, which is usually provided by the laser machine provider, is used to map the texture design with the mold CAD data. The software digitally applies the greyscale bitmap to the complete mold cavity, just like a foil used in etching. The software then optimizes the mold data, repairs mesh structures and eliminates warpage to make sure that a square structure remains square even on a spherical surface.

Reduced Lead Times

The design specialists need about two weeks to present the customer with a sample. "The big advantage is that we can develop design proposals long before tooling is in the manufacturing process, and the customer sees in advance how the surface texture of his product will look," Reichle explains.

Once the customer approves the design and clarifies all other formalities, and the tool arrives at Reichle, they immediately deliver it to the laser system and begin the process.

Lead times are reduced from two to three weeks to a couple of days compared to using conventional etching processes. The laser machines work 24 hours a day.

Reichle uses GF Machining Solutions' pulsed fiber laser systems. As soon as the laser beam hits the surface, it vaporizes the material with an accuracy of up to 1 micron. The fiber laser is a wear-free laser source that ensures stable ablation over a longer period.

Consistent, Transparent Data

An equally great advantage of a laser-textured surface, according to Reichle, is reproducibility because the data is consistent, transparent and always available. The error factors are very small, and the process is 100-percent repeatable.

Reworking and repairs are also easy to carry out. Reichle explains, "We weld material to a damaged or worn part of the mold, then we reprogram the machine from the existing dataset, define the area, and off we go. The machine finishes most of the work. Manual work is only needed in the last step. Designers must rework the transitions so that the repair becomes completely invisible."

Meanwhile, the small but rapidly-growing family business dedicates much of its manpower to the laser texturing business. And there is no end to this rapid growth in sight. Reichle and his young team (most employees are under the age of 30) have fully digitalized the business and aim to develop an intelligent database with an integrated product-configuring function, which will contain all necessary information to create the perfect structure.

"The customer will have to provide us with information like what texture he requires, what degree of gloss level, material, what tool steel he uses for the mold or what the molding temperature is supposed to be, and the database calculates the right manufacturing parameters. People make mistakes, and although that's what we live from in our repair department, our vision is to eliminate these mistakes and create the perfect surface." MMT

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By Cynthia Kustush

This article is part of a series of roundtable discussions with industry suppliers addressing recent trends in moldmaking, the challenges moldmakers are experiencing and the latest solutions that are or will be available to resolve them.

Surface Treatments Must Withstand Abrasion, Reduce Downtime and Achieve Part Perfection

Surface treatment vendors are expanding their services to include more treatment options, advanced technologies and convenience.

Image courtesy of Mold-Tech.

Surface treatments for molds are like icing on a cake. After a mold is built or repaired, moldmakers finish the mold by polishing and plating (coating) both cores and cavities, as well as any high-wear components.

Mold polishing is used to create smooth and polished surfaces using techniques like blasting, stoning, gritted paper or diamond buffing. Etching and lasers are used to produce texture profiles. Many still consider polishing an art form because it takes time, practice and patience to become skilled at it. Coatings options are more diverse today, though most incorporate some level of chrome or nickel to produce mold surfaces that resist corrosion and abrasion and promote better part release. Whichever finish a customer desires, more than anything the objective is to ensure the mold produces plastic parts better and faster.

MoldMaking Technology asked several surface treatment experts to reveal what they see in the industry regarding surface treatment trends, challenges and solutions.

Customers Want Protection, Longer Life, Perfection

Luis Gonzalez, president of SurfaceTec (Franklin Park, Illinois), says his company is seeing more molds with grooves for stiffening ribs. "Because these molds are processing high-percentage glass-filled materials, our customers are asking us to chrome plate those grooves, so the entire mold has substantially the same wear cycle," he says. "Without plating the grooves, customers see adhesion failures at the grooves while the body of the tool still has good release characteristics."

"The biggest trend we are seeing is the desire to extend mold life by protecting it from abrasion, corrosion and from parts sticking to the surface," Rich Wozniak, technical services manager at Bales Metal Surface Solutions (Downers Grove, Illinois). "More customers are using resins with higher percentages of fillers like glass (as high as 55 percent), wood and fiber. These are extremely tough on molds."

Gonzalez also points out that customers are increasingly requesting that his company perform repairs of large-scale molds on-site versus at SurfaceTec. He further notes that schedules are often a challenging priority. "We estimate that about 95 percent of the large-scale tools we refurbish don't

Surface treatment suppliers say customers are experiencing more surface wear due to abrasive molding materials and that they are looking for vendors to perform not only surface repair and treatments but preventive maintenance concurrently for added convenience and time savings. Here a mold polisher plies his craft on a very large automotive mold.

Image courtesy of SurfaceTec.

Shown here is a lighting mold refurbishment utilizing conforming wire anodes for the mold body. This helps to achieve a consistent plating thickness over the highly complex surface geometry of the mold for more even wear and excellent release characteristics.

have spares, so both moldmakers and manufacturers are under pressure to get repair and refurbishment jobs turned around fast before banked part inventories get exhausted. The schedule constraints seem to get further magnified for the surface finishing component of the process, so the challenge for us is to accomplish what we need to do in a compressed timeframe, and just as critical, get it done correctly," he says.

Lesley Murphy, sales and marketing manager, Mold Polishing Products, at Boride Engineered Abrasives (Traverse City, Michigan), concurs. "I asked Scott Williams, general manager of M&M Polishing Inc. (Coloma, Michigan), a longtime Boride customer, and he says that shops are requesting polishing houses to send polishers to work on-site where the mold is being run to avoid shutting it down and taking the time to ship the mold securely." She adds, "He also said that climate is a challenge when it comes to maintenance, repair and surface treatment. Climate varies from shop to shop as does the finish on each mold. M&M Polishing sees many molds that get pulled from the press without the proper rust preventative applied. The result is surface damage from water getting into the tool via condensation, a waterline leak, etc."

John Hoff, president of Nanoplas Inc. (Grandville, Michigan), says press downtime is very expensive, and molders want to minimize downtime and startup issues like scrap so that they can run more molds faster. "For moldmakers, often the challenge is in design," he says. "More intricate parts are creating challenges with releasing parts during production, so customers are using surface treatments and moving away from spray mold releases, which can be expensive and build up on the mold's surface. In the medical molding market, spray mold releases are sometimes not even an option." He adds that molders want better cleaners, rust preventatives and greases to minimize downtime and to improve startup times and reduce scrap.

Paul Williams, sales manager and senior program manager at Mold-Tech/Standex (Carol Stream, Illinois), says he is finding that customers are putting a higher emphasis on gloss management, consistency and maintenance. "Gloss management represents an important part of the product designer's vision of how the part looks and interacts with its surroundings," he says. In automotive interiors, for example, there is a desire for low gloss, low reflectivity within the cabin. Leather-grained textures are used to mimic leather, which in nature are always a low gloss or low sheen. Parts for automobile exteriors are often of a higher gloss, like headlamp assemblies and badging. In these cases, the higher-gloss parts look richer next to the higher-gloss trims and paints. "Gloss consistency represents quality, and gloss levels can change over time, especially when molding abrasive materials, so texture profiles may need to be adjusted to restore the original gloss."

Williams also notes that customers are experiencing more surface wear due to abrasive molding materials and that they are looking for vendors to perform not only surface repair and treatments but preventive maintenance concurrently for added convenience and time savings.

"There are so many coatings on the market today," Gene Bianco, president of Progress For Industry Inc. (Saegertown, Pennsylvania), says. He explains that his customers tend to plate new molds with nickel or a nickel co-deposit to enhance the molding process and extend mold life, but he advises them how important it is to know specific details about the mold before choosing a coating. "I tell them they must know to what temperature the plating process exposes the substrate material," he says. "I ask them whether they can control the coating buildup, keep the deposit uniform and easily remove the coating without losing any material."

> More customers are using resins with higher percentages of fillers like glass (as high as 55 percent), wood and fiber.

SurfaceTec's Gonzalez takes caution a step further, saying tools manufactured off-shore present their own kind of challenges. "Depending on where the tool originates, the standardization of base metals may be different than what we are accustomed to," he says. "For example, we may get basic engineering properties, but we don't know how much chromium or magnesium is in the alloy, which affects how the tool accepts plating, polishing, welding and so on."

Michael Muth, president of Slide Products Inc. (Wheeling, Illinois), cites cost as a challenge, pointing out that surface

treatments that are used to help improve processing efficiencies are considered investments rather than simple expenses. "Maintenance managers often need approval before making this sort of investment in their molds and tools," he says.

Greg Gesswein, president of Paul H. Gesswein and Co. Inc. (Bridgeport, Connecticut), says customers tell his team that their customers are requesting higher surface finishes, like a mirror or A-1 or A-2 diamond. "This presents a challenge for our customers who have to keep up with these demands," he says. "The interesting thing is that these high finishes are desired not only because the part requires it for functional purposes, but sometimes the customers simply want their parts to be shiny and perfect."

Solutions Embody Prevention and 'MacGyver Spirit'

"We are offering solutions that aid in protecting the substrate material. Let the coating take the abuse and save the mold," says Bales Metal Surface Solutions' Wozniak. "Doing this is more cost effective because it reduces the need for added maintenance and repair." He says that, depending on the percentage of fillers in the plastic material, a hard surface coating with a Rockwell hardness of between 67 and 85 can be very effective. "Nickel boron nitrite (67RC after post-bake) is great for your low-end glass-filled materials, and with a low coefficient of friction it aids in resin flow and part release," he says. "For high-glass-filled materials, a diamond-chrome coating at 85RC is great for abrasion protection."

Addressing customer requests for plating in grooves, Gonzalez says SurfaceTec uses a process for anode fabrication that combines individual bladed anodes that rest within the grooves with more traditional wire anodes for the tool body. "We're finding this allows us to achieve a consistent plating thickness both in the grooves and over the tool body," he says. An increase in challenging off-site refurbishments has motivated the company to miniaturize and make portable some processes that are not practical in application outside of the shop. "This has required us to think inventively, and we designed and fabricated new equipment for some of these jobs based on specific requirements. At the same time, we need to compress the usual timeframes by quite a bit, so the ability to staff these projects with experienced, key people who have the knowledge and 'MacGyver' spirit to improvise and solve problems on the fly is critical." Still, he stresses that while the cost-benefit compared to transporting a large tool

Parts Not Quite Up to Spec?

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back to a repair shop seems obvious at first glance, the on-site jobs require a lot of communication and preparation for both SurfaceTec and the customer. "We focus on this during the quoting phase, so the customer has enough information on project specifics and costs to make that cost-benefit decision."

Progress For Industry's Bianco says his company is striving to educate the molding world about how plating the entire molding surface for engineering changes can be accomplished with pit-free coatings up to 0.005-inch thickness or more. "This will save time and money by achieving a dimension change without building new tooling," he says. "We offer coatings that can be applied over 0.005 inches thick, evenly, no matter the configuration of the substrate."

"Nanoplas is known for its nano-thin coatings that can be applied to the mold in the tool room or the press, eliminating the need for spray mold releases," Hoff says. The nano-mold coating aids in release but will not change the surface of the mold. "It can last for up to 300,000 shots without reapplication, which reduces downtime," he adds. "We have introduced a new, NSF-listed grease that is capable of handling temperatures up to 500°F. Our cleaners, rust preventatives, and greases keep the mold surface free from buildup, which reduces surface cleaning frequency."

Not only does Mold-Tech/Standex offer polishing services to a mirror finish, Williams says the company is also expanding its "tool enhancement" services, including tool finishing, to meet customer demands for optimized mold function as it pertains to appearance quality. Some new and advanced capabilities include re-gloss services and more options for gloss adjustment, and proprietary mold coatings that offer corrosion and wear resistance, dry lubrication and extended mold life as well as a coating that re-contours the mold surface to cover any pores, crevices or etch marks. "When we say tool finishing, we are addressing more than just polishing. We can correct flash, minor E/C and weld damage," he says. "Mobile laser welding is a new offering from Mold-Tech. From our facility in McDonough, Georgia, we cover the entire Southeast region with our on-site repair capabilities, from Alabama to North Carolina and Tennessee to Florida."

Boride's Murphy says manufacturing, sourcing and distributing new products that remove material faster and leave a better finish is a priority. "We'll continue to bring new products to the table like diamond polishing products, rust preventatives and portable equipment that are effective and efficient in response to the evolving requirements of the moldmaking industry."

Skills-Based Solutions Work, Too

"A unique solution we are offering our customers, so they can answer the demand for high surface finishes, is our polishing classes," Gesswein says. "There is a lot of trial and error and learning through experience, and what we teach is the foundation of polishing and the basics and the principles."

He says the classes, which launched in 2013, have become a big hit, selling out months in advance. "We're getting good feedback and good referrals from people. The demand is there."

The class consists of a combination of classroom and hands-on instruction over two days. If there is interest, students can also get a crash course in micro-welding. Customized, on-site training is also an option. "If our customers have specific challenges or a specific need our instructors provide training in their shops," Gesswein says. "Many times, they might not have the latest technology for polishing, so we will bring our equipment. We work on their molds and their tools when on-site, whereas, at our facility, the students learn on sample blocks of metal."

Additionally, Gesswein says his company continually looks for new technologies and polishing equipment that the mold finisher would need to use to achieve high finishes, especially for complex parts that cannot be done by hand. "You need power tools to help you get into tight areas and to finish these complex parts within a reasonable amount of time," he says. The company's most popular polishing system features an ultrasonic tool, a rotary tool, and a profiler tool, covering the whole spectrum of power tools for precision polishing.

"I think part of the reason why more companies are interested in our classes is that they're losing the skill set from their experienced staff that's retiring, and so they're training a new generation." MMT

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By Matt Sand

Integrating the Power of AM into Injection Molding

The unique capabilities of metal 3D printing technology can complement moldmaking if the investment is justified.

3D printing has often been portrayed as a natural complement to injection molding. After all, injection molding is a high-leverage manufacturing process where extremely high tooling costs are offset by low unit costs at high volumes. Additive manufacturing (AM), particularly where metals are concerned, has presented the balancing value proposition with tooling and setup costs representing a relatively low figure in comparison to the steep per-part variable costs. However, innovation in these two fields has presented an intriguing combination of the technologies: using AM technology to produce molds and mold inserts.

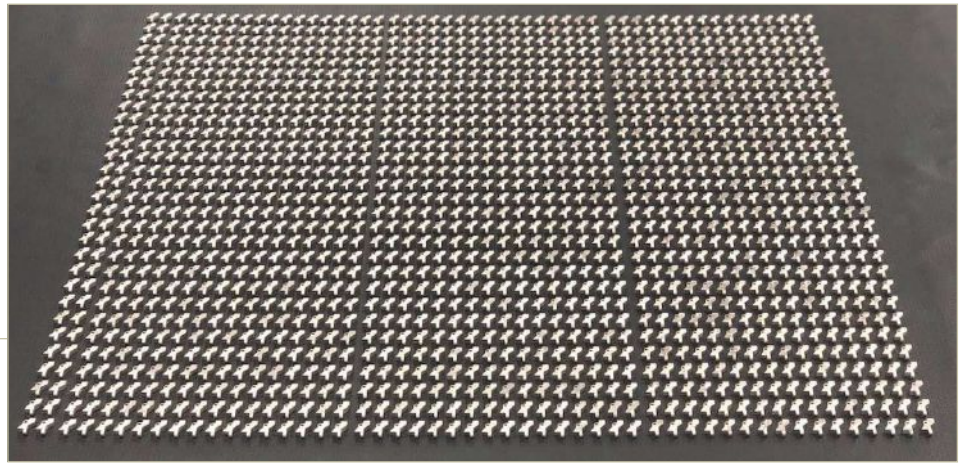
Some of the advantages to this approach closely mirror the advantages of 3D printing end-use products or components. For example, required changes are easier with printed mold inserts than with CNC-milled parts; highly complex, conformally-cooled mold inserts are easier to develop using AM; and, the cost of a 3D-printed mold insert can be significantly lower than a traditionally-manufactured mold.

Adding Up the Benefits

Let's take a closer look at a few key benefits of additively-manufactured molds and mold inserts. One of the principal advantages of 3D printing in comparison to *any* traditional manufacturing method is the *ease of design iterations for engineers*. In moldmaking, this advantage may be even more important because of the fixed costs associated with a CNC-produced mold. Given that setup costs can range from $10,000 to more than $100,000 for a ready-for-use mold, changes needed after their production can be very expensive. With AM, significant changes to an initial insert (or stand-alone mold) are possible with only CAD file adjustments.

> As a rule of thumb, low-run components produced using a 3D-printed mold insert will be less expensive on a per-part basis.

Another point to consider is that combining AM and injection molding in this way *allows prototyping that mimics full production runs*. For example, if a shop uses 3D-printed mold inserts for prototyping, they can use the same materials and process that they will ultimately use for production without the risk of a $100,000 restart. For parts that are destined to be injection molded at scale, AM gives designers the ability to test their process in near-identical conditions. If it becomes apparent that



Images courtesy of 3DEO.

Combining AM and injection molding allows the manufacture of low-volume components or prototyping that mimics full production runs.

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3D printing can help designers develop mold designs that solve part removability issues.

changes are required, the mold can be adjusted quickly and inexpensively.

Also, not every type of component is possible using a traditionally-manufactured mold. For example, some three-dimensional designs are simply beyond the reach of CNC machines to create. *Part integration or internal channels* that would be impossible with any other technique can be built into the design of a 3D-printed insert and transferred directly to the mold. This process produces parts that are good cost or volume candidates for injection molding to help determine the functionality advantages of designing for AM (DfAM).

There's also *removability* to consider. Some conventional two-part mold designs make getting the actual component out of the mold impossible. One innovative technique shops use to combat this issue involves using a 3D-printed plastic part to create a ceramic mold that can then be used to produce metal parts. The original plastic part melts away when the ceramic mold is heated. Metal is then injected into the resulting cavity during the transition to production.

Perhaps the most significant design improvement that AM can bring to mold manufacturing does not involve the final component. *Cooling channels*, which are simply channels built into a mold to allow air to circulate and cool the molded product, are straight in conventional molds. 3D printing has enabled engineers to design and build molds with conformal cooling channels that are engineered to contour around the shape of the part. This advance enables much faster cooling times, which shortens the overall cycle time needed to produce a part by injection molding.

A well-engineered conformal cooling system can potentially cut cycle times by between 20 and 40 percent. The implications of such an efficiency gain are enormous. They translate time savings into money, making 3D-printed conformal-cooled inserts a real game-changer. It's not a magic bullet, as significant research and engineering are required to introduce conformal cooling channels, but the transformational potential is real.

Justifying the Investment

However, using metal AM in moldmaking involves a Goldilocks calculation to get "just the right amount." First, a shop must understand that a printed mold will never match a machined mold's structural integrity because of the limitations of 3D printing materials. Machined molds can be made from super durable metals that are often outside the scope of what is possible with 3D printing. Therefore, a shop must take this into consideration when choosing metal 3D printing over CNC machining.

Part integration and internal channels are made possible with 3D printing. AM also gives designers the ability to test the process for parts that will be injection molded at scale in near-identical conditions.

Not every part is possible using a traditionally-manufactured mold. Some three-dimensional designs, like the one shown here, are simply beyond the reach of CNC machines to create.

Next, the application must be right for it to make economic sense. The *production volume* must be appropriate, the *materials used* must have a high resistance to heat and pressure, and the parts ultimately produced must possess a certain *level of complexity* to justify a flexible design process.

If a shop meets these criteria, the savings in both time and money can be significant. As a rule of thumb, low-run components produced using a 3D-printed mold insert will be less expensive on a per-part basis. The mold material, the molded material and the use of a mold insert or a stand-alone mold determine if a 3D-printed mold will last for as few as 10 or as many as 1,000 units.

In some ways, the limitations that hamper metal 3D printing in direct part production still constrain its adoption in mold manufacturing. Therefore, AM in moldmaking is still young and developing, but now is the time for innovative mold manufacturers to get a leg up on the competition. New materials are being introduced to the metal AM landscape almost daily, and improvements in this area will translate directly to the potential effectiveness of printed molds. MMT

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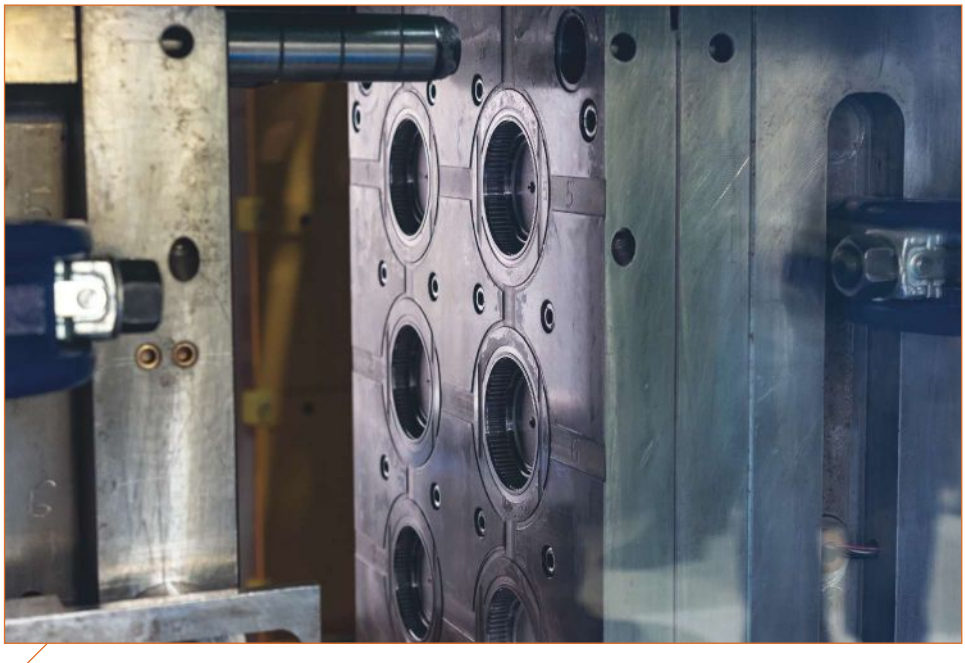
By Don Smith

Know Your Game, Know Your Business

Mold manufacturing is a numbers game rooted in measurement and data tracking to continuously improve.

Mold manufacturing requires using measurement to a shop's advantage because what gets measured, gets done. I've played golf with players who want to improve their game, and the one thing I noticed is that they keep track of their shots in one form or another (fairways hit, greens in regulation and putts). You might be asking, "Who am I to be tracking my stats? I'm just an average player." Well, average players can become good players, and good players can become exceptional players. You must introduce objective analysis to see areas where you can improve your performance, so you can maximize your practice sessions and work on those things that are causing the most grief in your game. Sometimes it is just easier to keep things vague and fuzzy, but if that impedes the results you are looking for, then it might be time to introduce some type of measurement to improve your game.

This is nothing new. If you've watched the Olympics, for example, you witnessed some of the most finely-tuned athletes in the world compete in events where hundredths of a second count. These are some of the most measured athletes on the planet. From their caloric intake to their workout repetitions and training schedules, they are measured in supreme detail because they know it produces results. It makes them better than the competition.



Mold builders must measure to identify areas where the business can improve performance, putting the shop at the top of its game.

Take some time to look at the stats at current PGA professional tracks on a regular basis. It includes strokes gained in putting, scrambling, sand saves, launch angle, swing speed and much more. It is all about developing consistency and measurements. If the PGA (Professional Golf Association) players track their stats to improve their performance and ultimately make more money, what stats do the PMA (Professional Moldbuilders Association) members track in their competitive arena?

Identify Your Stats

The first question is: Do you consider your company to be a tool shop or a high-tech business? Today's modern, growth-oriented businesses have stats

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to measure their success. So, how can you bring *measurement* into your mold-building business to achieve specific results? Consider these aspects as possible starting points:

- How do you know what your biggest moneymaking area is, and how do you capture and measure that?
- How do you measure your profit margin?

Since quoting is predicated on hours, consider these questions:

- How do you cost an hour? What is the "true" cost of an hour?
- How do you measure your break-even point?
- How do you measure direct versus indirect hours?

When using automation, consider these questions:

- How do you capture (measure) and cost unattended hours?
- How do you know what new automated equipment to purchase? (What measurements would you take?)
- What are the measurements of the type of work you do that will help you buy technology and enhance profitability?

This does not have to be complicated! Let's go back to analyzing our golf game to establish the process. Ask yourself: How can we bring measurement into our golf game to achieve specific results? First, decide on a specific and precise result. Perhaps you want to hit more fairways off the tee. Historical/statistical analysis shows that you are hitting about 40 percent of fairways and you want to achieve a consistent rate of 60 percent. Now you have a goal to work with, so it is time to introduce measurement to get precise results. Step one might be to make an appointment with a golf instructor to have him/her diagnose just what is happening to produce so many non-solid and off-center hits.

Next, you would need to set up a schedule. For example, practice for 45 minutes on Tuesday, Thursday and Saturday to work on that specific swing flaw and nothing else. That makes your practice session very clear and focused. Then head to the course, drop some balls and experiment a little. Try different lofts, grips types (strong left hand, weak left hand and neutral), and maybe even different driver manufacturers. Then record any insights or observations after the session and note when the next session is. Notes can include successful shots, unsuccessful shots, conditions and surprises. When you measure, you can adjust. It is very easy to look at and adjust your activity based on your results.

Measure and Track

Now let's look at the business and use the same process. Set the goal of finding the biggest money-making area of the business with the specific and precise result of finding the area that has the largest profit margin. First, identify the types of projects or the mix of work that makes up the business (see chart).

Review and analyze the profit margin historical data in each project category. Then establish a targeted profit margin for each, thereby establishing a measurable. What area brings in the greatest profit margin? You can even break down the type of new molds into a sub-category to be even more precise. For example, two-plate molds, molds with side actions, unscrewing molds, etc. Then calculate the best profit margin on new molds.

The key to establishing measurables is keeping and incorporating historical data into the process, which makes a post-project review critical. This review establishes the mathematical numbers that will become usable data for statistical analysis and continuous improvement. Now you have worked hard on each project and have created valuable information for your business. Do not waste

TYPES OF PROJECTS	PROJECTS IN HOUSE
ENGINEERING	0
NEW MOLDS	16
NEW COMPS	10
CHANGES	6
REPAIR	10
SAMPLE	0
WARRANTY	2
ON HOLD	1
TOTAL:	45
IN PROCESS:	44
SHIPPED LAST WEEK:	3
ACTIVE TOTAL:	41

Moldmakers can find the area of the business that has the largest profit margin by first identifying the types of projects or the mix of work that makes up the business.

this opportunity to use the beauty of mathematics. Quoting Albert Einstein: "Pure mathematics is, in its way, the poetry of logical ideas."

With this new information in your toolbox, the sales team can pursue more of one type of business or more of one type of mold to establish a more profitable mix. Tracking and measuring the types and quantities of the mix can help a shop establish a profitability probability equation, which they can ultimately turn into a KPI (Key Performance Indicator) for the entire business team.

Once the team has compiled all of the data, they should set up quoting templates to represent the statistical data for each category and type of mold, making this a more predictable process. The numbers do not lie. I have found over the years that introducing performance metrics can relieve pressure because you defined "very specifically" your result. Then all you have to do is follow the recipe to produce the result. It makes life (and your progress) easier.

Get Started

To begin, use the questions listed or create your own, but the process should be the same. In the end, if you did not come close to your goal, find another path that gets better results. Keep testing until the formula works.

The reality is that the next generation coming into our industry is into analytics and numbers. They crave that immediate gratification that the numbers will provide. They may even create an app for the business. These numbers will motivate and drive young men and women to create the future of our industry. Getting back to golf, World Golf Hall of Famer and Masters Tournament co-founder Bobby Jones said, "Golf is a game that is played on a five-inch course—the distance between your ears." By the way, moldmakers can apply that same "measurable" distance to their moldmaking businesses. MMT

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By Paul Powers

Managing Manufacturing Cyberattacks

Improving your shop's preparedness to deal with cyberattacks includes awareness and tools to stop them before they start.

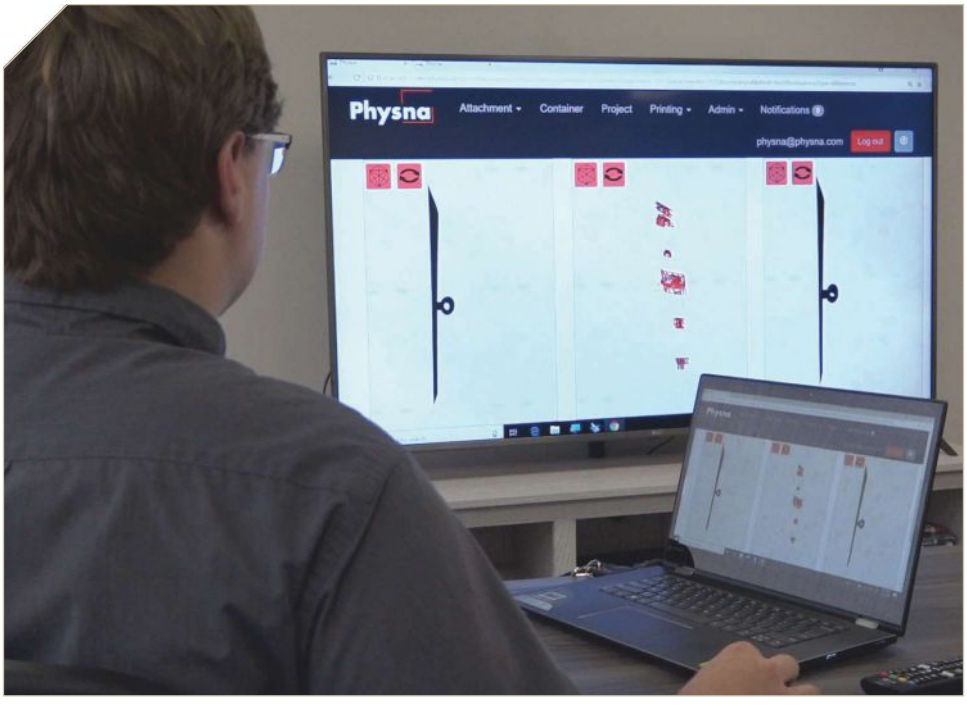

Image courtesy of Physna.

Manufacturing cyberattacks are expensive, hard to detect and dangerous. Companies can no longer sit idle and hope not to be a target. Hackers are stealing everything from personal information to internal operational details and intellectual property. A single data breach can cost a manufacturer a year's worth of proprietary information and lead to a permanent loss of customer trust. The damage to a company's reputation is practically unfixable.

The challenge for manufacturers is as supply chains, operations and facilities get more connected, the risk is more significant and far-reaching. The added challenge for small and medium shops is combining legacy equipment with modern technology, which adds to the security gap in many facilities. The final major hurdle is the modern technology itself. IoT devices were never designed to protect themselves from threats. Since robotic arms are not compatible with firewalls, for example, hackers are exposing those weaknesses. These facts make any shop a highly enticing payday for criminals.

What the Hack Is Going On?

Security researchers and analysts have raised questions about the manufacturing industry's preparedness to deal with cyberattacks. For example, Vectra, a company dedicated to enterprise-wide cyberattack detection, released its 2018 Black Hat Edition of the Attacker Behavior Industry Report this past summer, which provides insight into methods and types of attacks the manufacturing industry is facing. The key findings reveal that attackers who evade perimeter security can easily spy, spread, manipulate and steal, unhindered by weak internal access controls.

The report also shows a significant increase in malicious internal behaviors, such as when someone with access to a

A small- to mid-size shop must act as a human firewall, implement secure communication methods, develop a sophisticated password strategy, use a secure backup plan, be aware of the internal threats, educate employees and promote vigilance to protect their company data.

network deliberately sabotages work, which is a reliable indicator that attackers are already inside the network. Typically that is an employee or disgruntled employee working to harm a company's product(s) and reputation. On top of that increase, the report describes an unusually high volume of reconnaissance behaviors, such as when a hacker gets into a network and looks for anything of value to steal like models, intellectual property, shop operations or equipment. Hackers know that once they gain access to a manufacturing network, they can come in often because of the lack of cybersecurity. Reconnaissance behaviors are a reliable indicator that attackers are mapping out manufacturing networks in search of critical assets. Although this report paints a bleak picture for manufacturing today, the real challenge is how to better protect what companies are building for tomorrow.

For example, an attack on the supply chain is one of the worst-case scenarios as it will taint products or services at the time of their creation. However, what if criminals take it a step further? Another cybercrime scenario for engineers and manufacturers is the deliberate manipulation of design models and shop equipment, which are next to impossible to detect.

Those microvariations result in a real change that could make a part less efficient, shops unsafe and put lives in danger. Companies should consider any connected device on the shop floor at risk.

And, if you are designing parts that are mission-critical, the size of your company does not matter. You have to take cybersecurity measures, or else you take a big risk of failure.

Cybercrime software is the second layer of cybersecurity. The journey starts with people. It is essential for employees to be aware of best practices because they run operations, machines and other manufacturing assets.

Strategies for the Shop

An example of a cybersecurity tool to help protect your company is Physna software, which is used as a standalone or plugin for CAD software. When a user saves a file, data is analyzed and stored separately within Physna. When the user reopens the file, a quick check ensures no manipulation has taken place. If detected, the software displays the change, shows the data and a 3D representation of the exact change.

This cybercrime tool was initially designed to protect intellectual property because of the growing cybercrime problem. Physna, short for "Physical DNA," uses a series of advanced algorithms and artificial intelligence to break down and analyze models, their features, patterns, relationships and any similarities and differences between 3D models.

This software is the second layer of cybersecurity. The journey starts with people. It is essential for employees to be aware of best practices because they run operations, machines and other manufacturing assets.

A small- to mid-size manufacturer must act as a human firewall, implement secure communication methods, develop a sophisticated password strategy, use a secure backup plan, be aware of the internal threats, educate employees and promote vigilance to protect their company data.

Here are three top strategies:

- **Develop and share best practices with employees, partners and customers.** Anyone a company does business with can become a potential cyberthreat.

The Cost of a Data Breach

The Ponemon Institute, a research firm focused on privacy, data protection and information security policy, released its annual study on the cost of data breaches, breaking down precisely what lost and stolen records could cost companies this year. The simple breakdown is that each file stolen is valued at $148. If a company has 50,000 records taken the costs can total more than $350 million.

Companies need to be direct and make sure vendors, suppliers and partners are aware of those best practices. There are plenty of data breach examples where hackers stole the data through a third-party vendor, gaining access to millions of people. Begin your best-practices policy by securing communication methods.

- **Fortify your firewalls.** Firewalls are not enough. Shops should encrypt systems with anti-virus software. Shops should also incorporate sophisticated password strategies and install all security updates.
- **Monitor and record all activity.** Constantly monitoring shop systems is a proactive security strategy that actuates real-time detection. If hackers get into your company's systems, you have to be able to identify it first. The next challenge is to repair the damage and fix the vulnerability.

Detection is key. If program files do not match the program running the device, the shop must detect the mismatch, identify the deviations and alert the appropriate people. Do not assume your software will do it on its own.

Good record-keeping of incidents, alerts and advisories will help determine the true impact of the security policies in place. Lastly, protect your models. They are vulnerable to theft as well as manipulation. Back up and secure them in a central storage space. Being prepared will help undo unauthorized or malicious changes.

While cyberexperts have been protecting companies with vigilance, better password management and better employee education, companies are also working to make better tools to stop a cyberattack before it starts. MMT

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Common Software Platform Helps Die Caster Streamline Inspection/Measurement Processes Throughout Shop

By Robert Mooers

At Hyatt Die Cast and Engineering (Cypress, California), they measure the quality of the die-cast die by the castings (parts) it produces. But make no mistake, to get there requires a delicate dance between thermal dynamics, engineering precision, process and quality verification. For this reason, Verisurf inspection and measurement software has become an indispensable tool for ensuring that this balance is not shaken.

Over the last 62 years, Hyatt Die Cast has perfected the art of high-pressure precision die casting of aluminum, zinc and zinc-aluminum alloys (ZA) for aerospace, defense, medical, gaming, electronics and communications customers. The company's casting size capabilities range from less than one ounce to over 75 pounds.

There are several considerations that go into specifying high-pressure die casting to manufacture parts, including weight, strength, application, part anatomy and more. But the number one consideration is cost. Precision die-cast production parts are typically a fraction of the cost of hogging out parts using a CNC machine for high-volume production. Yes, there is additional time and cost in pre-production for die-cast dies, but once in production parts come off the injection line at a rate of about one minute per shot, with very little waste as nearly all the material is used in the part.

Images courtesy of Hyatt Die Cast.

The proof is in the part. Die-cast dies are designed with thermal allowances, so the dimensional quality is determined by part quality. Here, dies at Hyatt Die Cast are stored with a sample of the most recent part shot.

HYATT DIE CAST AND ENGINEERING

PROBLEM: Inefficiencies in pre- and post-casting inspection processes for die-cast dies and castings, caused by multiple software applications and incompatible CMM devices.

SOLUTION: Verisurf 2018, inspection and measurement software.

RESULTS: A common software platform that provides both quality verification of parts and reverse engineering applications across the manufacturing process.

Lower part cost does not translate to lower quality or ease of manufacturing; there are more critical processes involved in precision high-pressure die casting than in CNC milling or turning. These include more material variables, tooling considerations, thermal properties and finishing steps that all have a bearing on the final parts produced. Precision and quality verification must accompany each process to ensure end-to-end quality.

Measurement and Monitoring Efficiency Keeps Part Costs Low

In high-pressure die casting there are no shortcuts to quality and ultimately, success is based on how the job is engineered and set up from the get-go. Any mistakes up front, designing or manufacturing the die-cast die, will have a negative effect on the entire production run. Since eliminating steps in the manufacturing processes was not an option, Hyatt Die Cast realized the way to save time was to be more efficient in the pre- and post-casting processes, including reverse engineering of legacy parts to aid in design and engineering of dies, and quality verification and reporting throughout the entire setup and production process.

For quality monitoring, during the casting process, a combination of inspected certified material, spectrometer monitoring for chemical analysis and real-time x-ray of parts to check material density maintains and confirms consistency. These are important verification steps to delivering a solid part, but the area where Hyatt Die Cast has realized the greatest improvement in quality efficiency is dimensional verification across the manufacturing process, which is where Verisurf comes in.

Common Platform Improves Inspection and Measurement Efficiency

Precision high-pressure die casting is a refined manufacturing process; once the job has entered the line a shot is a shot is a shot. Rough parts come off the line for post-processing, and the overwhelming efficiency promise of the die-casting process has been realized. But there was a lot of work to get to this point and still a lot to do before the final part is ready for shipment to the customer.

Verisurf quality inspection and measurement software was added to serve as a common platform, capable of interfacing with all coordinate measuring machines (CMM) and portable CMMs in the company's quality lab. "Verisurf software was selected because of its ability to work with all CAD files, including 2D CAD, 3D CAD models and paper drawings," Alfredo Gomez, quality systems manager at Hyatt Die Cast and Engineering, says. "The software reads in intelligent CAD files, including nominal geometric dimensioning and tolerancing (GD&T) datums that we can edit or add additional annotations to when developing die-cast dies or creating inspection routines."

Gomez says that before switching to Verisurf the Hyatt Die Cast quality team comprised seven individuals, each with local knowledge of specific measuring devices and supporting software. Three different inspection and measurement software programs were in use across multiple fixed CNC CMMs and portable CMMs, including the company's Faro portable CMM, two Mitutoyo CNC CMMs and one Zeiss CNC CMM. This was due to incompatibility between the various hardware and software required to run the equipment. The result was stifled productivity and frequent bottlenecks waiting for a particular inspector or device to become available.

Hyatt Die Cast uses Verisurf Software to verify first article die castings against a paper drawing, as shown here. Verisurf also works with all CAD files, including 2D and 3D CAD models. The operator can then complete detailed first article inspection reports in the software program.

Today, Hyatt Die Cast uses Verisurf to provide first article inspection and reporting, automated inspection and reverse engineering for both pre- and post-casting processes, which include reverse engineering, first article inspection, post-production inspection and secondary operations inspection. The software quickly and easily creates automatic and manual inspection routines and serves as a common software platform that is capable of sharing inspection plans across CMM devices.

"We have saved a lot of time and have seen improved workflow efficiency since switching to Verisurf software," Gomez says. "The software's model-based approach to inspection and measurement and its common platform capability has enabled everyone in our QC Department to inspect and verify die-cast die components and casted parts regardless of the measuring device used. This has saved us time and money on training, data management and software maintenance."

Since implementing Verisurf Software, Hyatt Die Cast has realized a net gain in efficiency (time savings) of five times for first article inspections, production inspection and reverse engineering. All existing measurement hardware remained in place and in-use, and is now driven by Verisurf, without requiring additional hardware, firmware or other software.

Software Facilitates Process Integration

Verisurf software was integrated within the bookends of the manufacturing process: pre-casting setup and verification, and post-casting cleanup, finishing and secondary operations. "The company's basic processes and need for quality verification did not change, just the quality inspection and measurement software did, with its ability to work with all measurement hardware devices," Ernie Husted, president and CEO of Verisurf Software, says. The resulting increase in efficiency was immediate.

Reverse Engineering: Customer part information usually arrives via an intelligent 3D CAD model or drawings, but occasionally only a legacy part or prototype is provided. In this case, Hyatt Die Cast uses Verisurf Software to reverse engineer the part to an intelligent 3D CAD model. The model is then used as the virtual part for all die-cast die design, inspection and reporting throughout the entire manufacturing process. Depending on the part size and geometry, the Faro portable CMM or Mitutoyo CNC CMM will be used with a contact probe or non-contact scan head to capture point cloud data.

First Article Inspection: The die-cast die is designed and manufactured with required shrinkage calculated and added in. If

engineered and designed correctly the finished die is assumed to be correct. After visual inspection, the die takes its place on the injection line and is set up for a test shot. After the test part has rested and is stabilized, it is returned to the quality lab for first article inspection and reporting. The quality lab and CNC shop are kept at a constant temperature and humidity level (ANSI 2540.3), control of measurement and test equipment) for consistency of part expansion/contraction during finish machining and inspection.

Precision high-pressure die castings can be shot to a production tolerance of ±0.002" - ±0.005". If tighter tolerances are necessary, the die can be made oversize and finish machining can deliver the part ±0.0002.

Post Production Inspection: After casting, production parts can rest and stabilize. Then they are trimmed to remove flash and deburred before the final machining process to add any additional features and remove excess material to specification. The parts are then moved to the matching climate-controlled quality lab for final inspection using Verisurf Software. Based on the number of parts requiring inspection, either a CNC CMM running an automated inspection routine or manual portable CMM will be used. Regardless of which device is used, they will share the same Verisurf inspection program.

Secondary Operations Inspection: Hyatt Die Cast operates its own powder coating line in-house, but any time parts leave the facility for other outsourced operations, such as chem film or anodizing, they are inspected before they leave and when they return.

Conforming to Workflow

"Open CAD-based software solutions such as Verisurf Software provide the flexibility necessary to support die- and injection-mold-based workflows of all types. It is important that your measurement software be adaptable to your processes, not the other way around. Closed proprietary systems that fail to support unique workflows or other applications have no place in today's rapidly evolving manufacturing environment," Husted says. MMT

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Robert Mooers is a writer and consultant in the manufacturing industry, focusing on practical implementation of products and services from the customer point of view.

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Maintaining Mold Components

By Steve Johnson

The typical injection mold comprises hundreds of types of plates and tooling components that help to form and eject a molded part. Component type, required function and construction dictate the proper maintenance procedure and frequency plan. To help toolroom technicians better understand the time and money they are spending on mold component maintenance, we have classified mold components into three categories: frame plates, frame components and cavity tooling.

Frame or base plates include only the individual mold plates, which can range from seven plates in a simple stripper plate mold to 20 or more, depending upon mold size and complexity. *Frame components* include all tooling that is within the frame that does not form the part. For example, guide or leader pins, bushings, return pins, interlocks, bolts and seals. Ejector pins are often also placed in this category. *Cavity tooling* is the most critical and expensive tooling in a mold because it includes the cavities, cores, sleeves and pins that directly form the part. Cavity components dictate dimensional and aesthetic part features, so they are costly to build and replace.

A toolroom should view a report that breaks down mold maintenance and repair costs according to these three categories to identify mold problem areas and to track component maintenance correctly. A good rule of thumb is to base the severity of a problem area on maintenance cost (tooling and labor) per hour of production, or in some cases per 100,000 cycles of run time. This information helps to create accurate maintenance PM frequencies and build better molds.

Proper mold-component maintenance depends on a toolroom's ability to recognize when and how a specific component needs attention. Every mold ever built, or that ever will be built, has a weakness. The design, build or production process can cause this weakness, which results in mold function or part quality issues if the toolroom leaves a mold unattended for a specific amount of run cycles. It is the tool shop's responsibility to have procedures in place to recognize the cycle count at which a certain component requires specific attention. If a toolroom understands a mold's performance characteristics and the conditions that wear out certain mold components, it can prevent these problems and greatly reduce breakdowns and quality issues.

Component design many times controls PM frequency. For example, if a component is moving (dynamic) then frictional wear becomes a huge factor in component longevity. Also, if a component is fixed (static), it can experience corrosion through water, off-gassing, condensation, abrasive resins, plate-out and hobbing from clamp pressure on preloaded components.

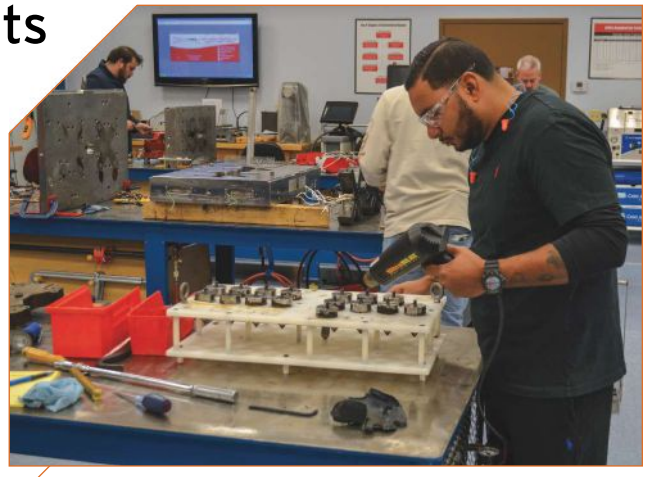

Image courtesy of Mold Trax.

Delicate tooling components, such as these hot runner nozzles, should be placed in a tray that keeps them separated so they do not bang into each and cause damage. The eyebolts at the corners of the tray allow it to be placed directly into an ultrasonic tank for cleaning. Then the components are dried using compressed air, which saves steps and time, and reduces handling risks.

Design, Build, Run

Let's review some mold characteristics that cause premature component wear or breakage. (These are not listed in order as specific molding environmental conditions affect mold components at different levels.)

A molded part's physical features, resin type and required volume dictate mold design and build quality. Molds are graded. SPI 101-classified molds are at the top of the class. Any molds classified less than 101 avoid certain design and build features to reduce mold cost, which can greatly influence component life when the shop runs the mold beyond the specified cycle count.

Regardless of mold grade, the molding process will subject many dynamic or static mold components to excessive wear and breakage depending on tolerance levels (too tight or too loose), steel quality, and hardness. Steel hardness between dynamic tooling that varies by more than two points can cause premature wear or galling, *assuming* that the toolroom is performing timely PMs. Cheaply-made mold components of substandard, soft steels and poorly-designed mold components with excessive pre-load will wear prematurely even with regular maintenance.

Other molding conditions such as how the shop sets up and runs the mold can be the root cause of many mold component issues. Molds bolted in improperly, platens out of square, hard mold closings, over-stroking mold openings, leaving heaters on during a shut-down and a lack of proper grease during long runs are just a few of the issues that shorten component life.

Handling

The way a repair technician handles a mold can be harder on component life than the actual running of the mold. Often, a

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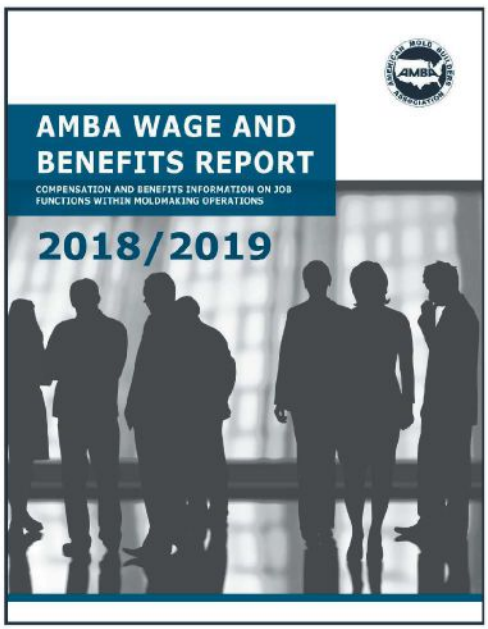

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repair tech disassembling and cleaning a mold using too much force with the wrong tools or too coarse or abrasive cleaning methods will mix up, ding or scuff mold components. One common myth in some toolrooms is that the tech can get away with excessive force during component removal and installation if they use brass, copper and aluminum tools because they are soft. This is not always true as they can still round over and crack sharp edges, and create burrs that will eventually cause galling and excessive wear. As soft as brass, copper and aluminum are, they will still chip and flake. These small slivers will fall into the wrong places during assembly and cause out-of-stack component issues, binding and galling.

Repair technicians must pay attention to the type of tool and the amount of force they apply when removing or installing components. Techs must correctly size punches on sleeves and pins with appropriate clearance to avoid jamming, dinging or rounding critical edges. They must also clean up the faces of a punch and remove the mushroomed head that forms after months of use.

Once a tech removes the mold components, they should not haphazardly toss them into cleaning baskets and swish or agitate them in solvent tanks, as this causes small dings and burrs. They should also not clean components with coarse scouring pads, sandpaper or stones, or use a sandblaster with glass beads, walnut shells or aluminum oxide. We recommend soft, plastic media, along with ultrasonics and dry ice. Techs should place delicate cavity tooling on a plastic rack to prevent them from banging into each other.

There are many available sources with opinions on how to build molds, many of which are steeped in personal experience. Others are not, and it shows up in the quality and performance of the mold that shop builds. Providing accurate feedback to these sources so the information can be used to help design and build better tools is an important part of a toolroom maintenance program. Technology for designing and building molds continuously advances, but it will never replace accurately documented mold performance hindsight. MMT

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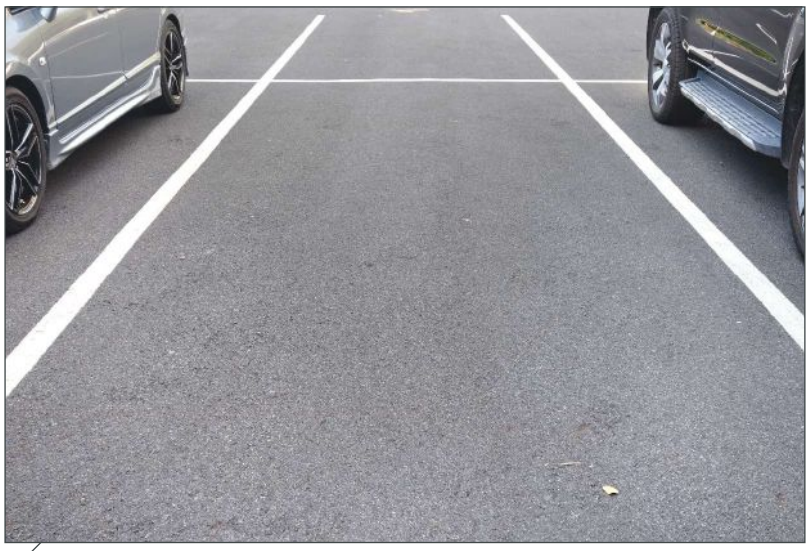
New Tax Rules for Employee Parking Expenses

By Michael J. Devereux II, CPA, CMP, Timothy O'Neill, CPS, Joel Hundelt, CPA

If mold shops are unfamiliar with the term Qualified Transportation Fringes (QTFs), they will know the term when they file their 2018 Federal income tax return. The reason is the Tax Cuts and Jobs Act (the Act), which does not allow any deduction for QTFs provided by mold shops to their employees, and is effective for amounts paid or incurred after December 31, 2017.

QTFs include any transportation in a commuter highway vehicle between the employee's residence and place of employment, any transit pass and qualified parking, which is defined as parking provided to an employee on or near the business premises of the employer, or on or near a location from which the employee commutes to work. The QTF with the greatest impact on mold builders is qualified parking, as many shops provide parking for their employees at no cost to the employee.



When it comes to calculating the amount of nondeductible expenses for employee parking, determine the primary use of any remaining spots such as non-reserved employee spots, general public parking and customer parking.

The Act does not help to determine the amount of nondeductible QTF, but proposed guidance from the IRS is forthcoming. The method chosen depends upon whether the mold shop pays a third party to provide parking for its employees. For example, the lot is not directly owned by the shop or its owners, or the shop owns or leases a parking facility where its employees park.

Generally, the amount of nondeductible expenditures is the shop's total annual cost of employee parking paid to a third party. If the monthly cost of parking is less than $260 per employee, the entire amount is treated as nondeductible. If the monthly cost is more than $260, the amount up to $260 per employee is nondeductible and the excess amount is treated as compensation to the employee and the shop can treat it as a deductible.

The IRS recommends the following steps to determine the amount of nondeductible expenses:

- Step 1: Calculate the disallowance for reserved employee spots.

$$\frac{\text{Reserved Employee Spots}}{\text{Total Parking Spots}} \times \text{Total Parking Expenses} = \frac{\text{Nondeductible}}{\text{Portion}}$$

- Step 2: Determine the primary use of remaining spots (non-reserved employee spots, general public parking, customer parking).

- Step 3: Calculate the allowance for reserved non-employee spots.

$$\frac{\text{Reserved Non-Employee Spots}}{\text{Total Remaining Parking Spots}} \times \frac{\text{Remaining Parking}}{\text{Expenses}} = \frac{\text{Deductible}}{\text{Portion}}$$

- Step 4: Determine the remaining use and allocable expenses by calculating the number of spots, the number of employees, the hours of use or other measures.

Parking expenditures include, but are not limited to, repairs, maintenance, allocable utility costs, property taxes, insurance, allocable interest expense, snow and ice removal, trash removal, leaf removal, cleaning, landscape costs and security expenditures.

Tool shops will likely benefit by developing processes, along with internal controls, on how to account for expenditures related to employee parking and the related tax reporting requirements. MMT

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Maximum Mold Group

In this column, *MoldMaking Technology* invited the owner of our 2018 Leadtime Leader winning shop to share his thoughts on his die-cast die work.

When did Maximum Mold Group get involved in building die-cast dies and why?

Dave LaGrow, President, Maximum Mold Group: As an apprentice first starting in manufacturing, I was trained to build die-cast dies at the same time I was being trained to design and build plastic injection molds. A moldmaker is qualified to build both die-cast dies and plastic molds. Designing die-cast dies may be different, but if you understand tolerancing, a shop can build both. Maximum Mold Group designs and builds die-cast dies mainly for the automotive market, but also the appliance, aerospace and agriculture industries. The same markets for which we design and build plastic injection molds.

How does die-cast die work complement Maximum Mold's injection- and blow-moldmaking capabilities?

LaGrow: Offering die-cast dies and trim dies enables the company to maintain a diverse customer base. Plus, building die-cast dies and trim dies requires most of the same equipment we use to build plastic injection molds, so no additional investment is necessary to enter the die-casting space.

How does your die-cast die work influence your mold manufacturing work and vice versa? What can be learned from one process and applied to the other?

LaGrow: Die-cast die work and plastic injection moldmaking exist on opposite ends of the spectrum due to their inherent requirements, but the complexities of a modern die-cast part require an in-depth analysis of parting lines, cooling, and clearances similar to that of a plastic injection mold. Using a plastic injection moldmaking approach to our die-cast die work, such as designing dies that require less EDM work and more five-axis cutting for efficiency, allows us to build reliable tooling and to implement greater processing efficiencies.

How is the business climate for die-cast die work (as compared to moldmaking)? What does 2019 look like for this segment of your business?

LaGrow: In my opinion, the business and workforce climate is the same for both the moldmaking and die-cast die markets. Automotive is the largest market segment for both, and they each face the same challenges when it comes to competing in a global marketplace and finding engineers who have the required experience and knowledge to work in the field.

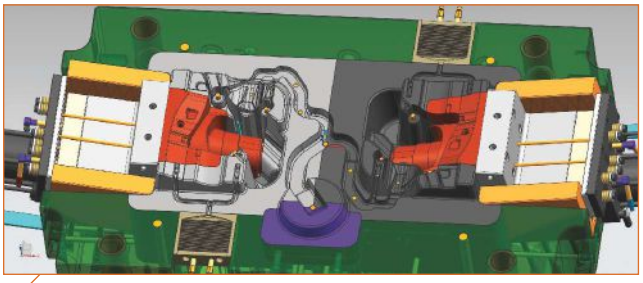


Image courtesy of Maximum Mold Group.

Maximum Mold uses the latest in CAD/CAM software to design cost-effective maintenance and quick die change capabilities into every die and mold its produces.

What are some specific challenges in die-cast die work?

LaGrow: A big challenge is finding better ways to cool areas in the tool where most of the heat creates failure or finding coatings and materials that withstand the heat better.

How do you stay on top of these trends?

LaGrow: The key for us is staying in touch with technology suppliers, especially with those who have special-application components for cooling difficult-to-reach areas, offer additive manufacturing equipment and services for conformal cooling and standardized components specifically for the die-cast industry.

We also speak regularly with coating and material experts to learn about new options and hear success company stories with different applications. However, sometimes, you simply need to go with your gut about a certain theory you believe might be effective and test it yourself.

What equipment and software do die-cast die makers require that is similar to and different from moldmaking?

LaGrow: The same design and toolpath software are used for injection mold and die-cast work because the same machines are used to produce the tooling. However, due to the different material properties and injection methods, the flow simulation software differs. Plastic molds use mold flow simulation software to help determine gate type and size, as well as hot runner specification. Die-cast software, such as MAGMASoft, simulates the most effective gating locations to properly fill a die-cast part while controlling solidification. MMT

EDITOR'S NOTES

For more information on how to enter our Leadtime Leader Awards program, or if you have a question for any of the Leadtime Leaders, please e-mail Christina Fuges at cfuges@gardnerweb.com, or visit short.moldmakingtechnology.com/leader

Moldmaking Index Sets Record in 2018

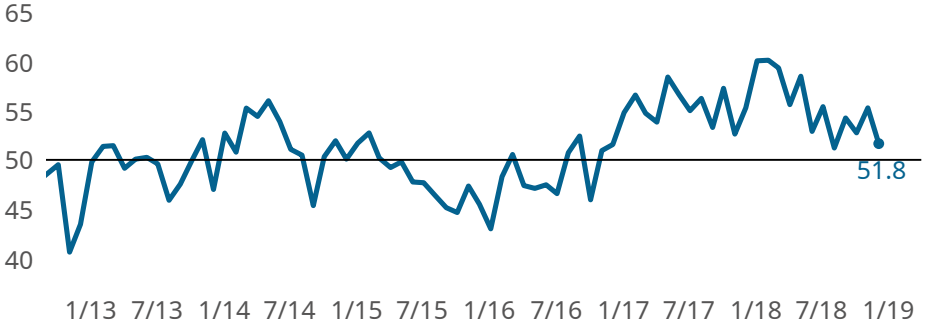
December 2018 – 51.8

Ending the year at 51.8, the GBI: Moldmaking expanded at a slower rate than in recent months. Gardner Intelligence's review of data reveals that new orders, supplier deliveries and production lifted the Index higher. In contrast, backlogs, employment and exports pulled the Index lower. Both employment and exports contracted in the latest month. The moldmaking industry continues to report that supplier deliveries are expanding above historical long-run rates. Gardner believes that recent months of above-average supplier delivery readings are a result of the unprecedented growth in new orders during 2017 and early 2018. Supply chains may still be responding to the large inflow of new orders from this earlier period. Coordination between suppliers and the mold industry will be important so that inventories are properly adjusted and the industry can smoothly transition to a more sustainable growth rate. December should also be noted for ending the longest period of consecutive employment growth in the history of the Index at 25 months. The prior record of 11 months was established in 2012. MMT

ABOUT THE AUTHOR

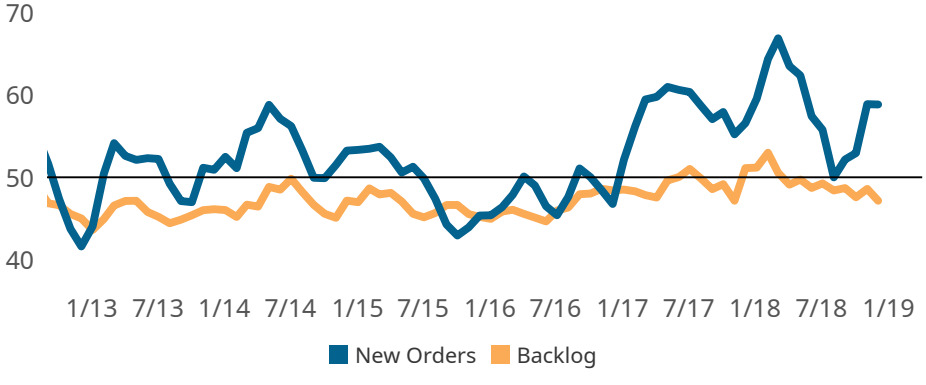
Michael Guckes is the chief economist for Gardner Intelligence, a division of Gardner Business Media (Cincinnati, Ohio, United States). He has performed economic analysis, modeling and forecasting work for nearly 20 years among a range of industries. He is available at mguckes@gardnerweb.com

Gardner Business Index (GBI): Moldmaking



Data from molders indicated strong expansion in new orders, supplier deliveries, and production and yet an eroding picture according to readings for exports and employment. This may suggest that multiple factors are having a strong impact on the industry.

New Orders and Exports (3-Month Moving Average)



The second half of 2018 has seen new orders readings trend higher while exports have contracted. Production and backlog data suggest that domestic orders are more than offsetting declines in exports.

Packaging Growth Indicates Strong 2019

As the plastics industry adjusts to 2018's higher new orders volumes, capital expenditures in the industry have increased significantly.

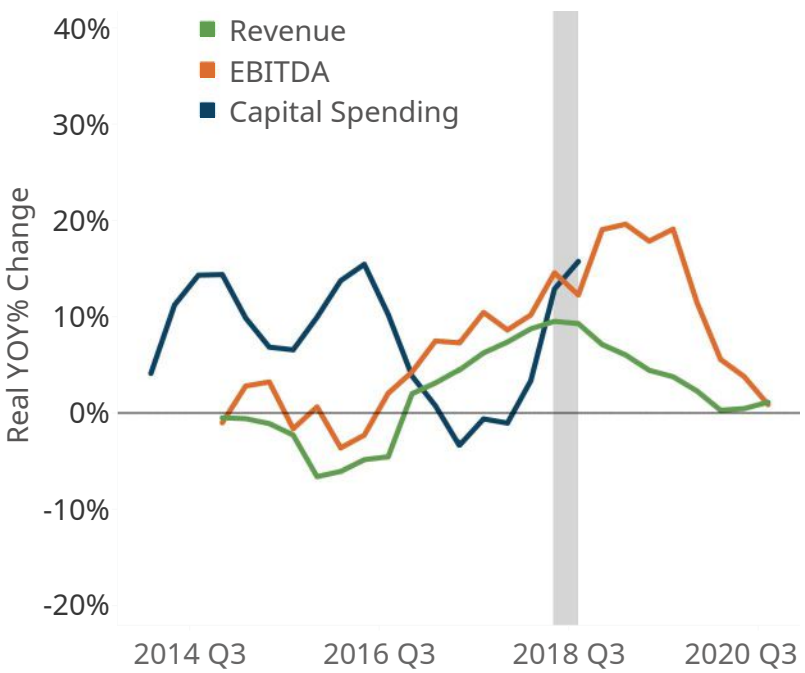
Using the financial data submitted to the Securities and Exchange Commission (SEC) along with forecasts provided by major Wall Street brokerages, Gardner Intelligence has compiled the financial results for 17 publicly-traded firms in the containers and packaging sectors to assess the current and future state of the industry. The results reveal an industry that has experienced eight consecutive quarters of revenues and earnings growth through the third quarter of 2018. Total inflation-adjusted revenue and earnings growth during this time were 12.6 percent and 18.6 percent, respectively. In the latest quarter, the containers and packaging sectors achieved year-on-year revenue growth (known as the "12/12" rate of change) of 9.2 percent. Similarly, earnings before interest, taxes and depreciation (EBITDA) achieved a 12/12 growth rate of 12.2 percent during the same period. These strong results enabled the industry to achieve a profit margin not seen since the great recession.

The industry's financial success in recent years has also been well captured by the Plastics Processing Index (a product of Gardner Intelligence), which measures fundamental business conditions as reported by plastics processors. Among the six components that constitute this Business Index, 2017 and 2018 data indicate an industry which has rarely expanded faster. The Index since 2017 has been driven in large part by growth in new orders, production and supplier deliveries. Backlog data collected since the first quarter of 2018 suggests that the industry has struggled to raise production levels sufficiently to match new orders growth, resulting in significant expansion of backlogs in the current calendar year.

As the plastics industry adjusts to the higher new orders volumes in 2018, capital expenditures in the industry have increased significantly. The 12/12 rate of change ending in the third quarter of 2018 saw capital expenditures rise by 16 percent. Similarly, the supplier deliveries component of the Plastics Processing Index has experienced unprecedented expansion readings in 2018. Since May, supplier deliveries has been the fastest expanding component of the Index.

Using the aggregated financial forecasts provided by Wall Street analysts for the firms used in this study, the industry in 2019 and 2020 is expected to see on-going but slowing growth in revenues after climaxing sometime during the second-half of 2018. As revenue growth slows starting in 2019, EBITDA growth is also expected to slow in the quarters afterward. However, aggregated projections do not show revenue or earnings growth falling below 4 percent until the third quarter of 2019 and second quarter of 2020, respectively. This suggests that containers and packaging sectors will grow faster than the overall economy for most of 2019. MMT

Containers & Packaging Industry Actual & Estimated Results
(3-MONTH MOVING AVERAGE)



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CUTTING TOOLS

New End Mills Provide Cost-Effective High Performance on Tough Materials

Seco Tools' new Jabro-Solid2 JS 750 end mills are designed to provide longer tool life when machining tough materials. According to Seco, shops that struggle to maximize end-mill tool life when machining challenging materials can now achieve 25 percent to 40 percent longer life with this new family of end mills.

The JS754 and JS755 cutter geometries optimize conventional side milling, roughing and slotting, as well as advanced roughing and dynamic milling operations. Instead of struggling with chip formation, the smooth peripheral rake faces and strong radius design of these cutters evacuate chips efficiently while maintaining a true radius form. To avoid slow or unreliable cutting when interpolating or ramping for pocket machining, increased front back tapers enhance speed and reliability.

The broad range of JS754 and JS755 variations and features ensure the highest cutting performance. Shops can match tool to application with various lengths, OD neck reduction sizes and corner radii, as well as chip splitters and through-coolant options.

Seco Tools, LLC / 800-832-8326 / secotools.com/us

Circle-Segment End Mills Enable Faster Machining Cycles and Smoother Finishes

Emuge Corp. circle-segment cutters are a class of end mills designed to enable substantially more material removal with fewer passes in five-axis machining. The company says they also reduce cycle times by more than 80 percent and produce up to 50 percent smoother surface finishes.

Emuge says these cutters are ideal for moldmaking applications. They feature unique forms with large radii in the cutting area of the mills, allowing a larger axial depth of cut during pre-finishing and finishing operations.

Circle-segment solid-carbide end mills are offered standard in four geometries: barrel-shaped, oval form, taper form and lens shape. Oval and taper form mills are ideal for curved shapes such as straight-walled pockets, freely engaging more of the cutting edge. Barrel design mills provide highly effective flank milling to the sides of spiral grooves and similar applications, while lens shape mills excel in narrow channels or in lands on molds.

Emuge Corp. / 800-323-3013 / emuge.com

New Indexable Insert Drill Provides Trouble-Free Drilling in Virtually All Conditions

Walter has introduced the D3120, an indexable insert drill it says is built to provide trouble-free drilling in virtually all conditions. The D3120 features square positive indexable inserts with four cutting edges, enabling it to reduce cost per cutting edge.

Available in five diameter sizes ranging from 0.63-1.654-in (16-42 mm) and with 2, 3, 4 x Dc, the new drill delivers maximum process reliability with simple and efficient chip removal, two coolant channels and polished flutes. Superior protection against friction is provided by the D3120 hardened and polished surfaces. This combination of surface hardness and improved coolant flow results in reduced wear on the drill surface.

The new drill is easy to use since it has one indexable insert shape for both outer and inner seat, and a measuring collar for easy diameter identification. The drill is suitable for ISO material groups P (steels), M (stainless steels), K (cast irons), N (nonferrous) and S (super alloys). Torx Plus screws give it secure indexable insert clamping and high stability in all working conditions.

The D3120 features long tool life because of Walter Tiger·tec Silvergrade, which features increased wear resistance due to its unique aluminum oxide layer with optimized microstructure, as well as low wear due to the extremely smooth rake face it creates.

Walter USA, LLC / 800-945-5554 / walter-tools.com/us

Solid Carbide End Mills Offer Four Cutting Actions in a Single Tool

Millstar says its new Quad Force Machining Tooling System provides maximum flexibility by way of its innovative hybrid geometry. The company says the line of solid carbide end mills is capable of four cutting actions in a single tool, making it a cost-efficient solution for diverse application challenges in mold and die making.

QFM's hybrid design combines high feed geometry, variable flute geometry, variable helix geometry and off set geometry. This unique combination allows users to seamlessly integrate multiple machining operations including high feed machining, trochoidal machining, side/slot milling and plunge milling.

Millstar's QFM end mills are said to offer superior metal removal rates in soft or hard tool/die steels, stainless steels and titanium. Their state-of-the-art geometry provides accuracy and repeatability while achieving greater depth of cut and preventing side vibrations. The durable QFM Tooling System also features a multi-layer hybrid nanocoating for excellent heat resistance and high hardness, which facilitates higher productivity and longer tool life.

Quad Force Machining end mills are made in the United States.

Millstar / 877-645-5782 / millstar.com

ADVERTISERS' INDEX

THIS MONTH ONLINE SOCIAL MEDIA

YouTube Videos

MMT's Christina Fuges sat down with Westminster Tool's Director of Talent Development, Kylee Carbone, to learn about Westminster Academy and the shop's unique onboarding process for new employees.
youtube.com/c/moldmakingtechnology

Popular Posts

Here are the top 10 *MoldMaking Technology* Facebook posts that made an impression in 2018.
facebook.com/moldmakingtechnology

@MMTMag Hot Tweets

2019 U.S Machine Tool Consumption Projected to Grow 11 Percent @GardnerIntel.
Twitter.com/MMTMag

Conversations

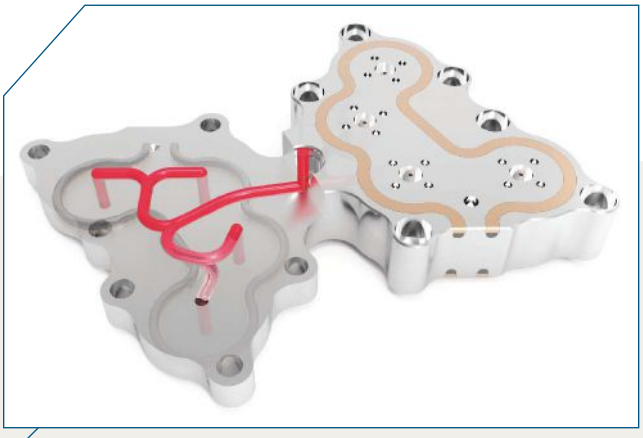
MMT recognizes the industry's young talent through its 30-Under-30 honors program, and now offers this exclusive LinkedIn group for them to connect and network.
linkedin.com/company/moldmakingtechnology

Photo Share

MMT's Christina Fuges and Cyndi Kustush suited up to break down molds at a Mold Trax Maintenance Center workshop.
instagram.com/moldmakingtechnology

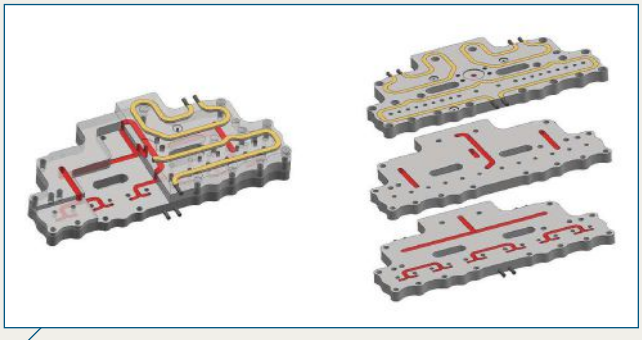
HOT RUNNERS

Improve Melt Distribution with Diffusion-Bonded Manifolds



Images courtesy of Yudo Inc.

This four-cavity, eight-drop cell phone case application delivers uniform melt flow to two drops in each cavity for balanced filling.



This inline 12-cavity toothbrush application delivers balanced melt flow in a challenging linear layout.

By Rick Unterlander

As production demands rise, engineers find ways to maximize mold cavitations and minimize cycle times, placing a high demand on hot runner system performance. Designing a hot runner can be a challenging task, as the melt flow paths should be geometrically and dynamically balanced, yet maintaining temperature uniformity throughout each channel. This is where diffusion bonding can influence the initial design process to yield several molding benefits.

Diffusion bonding was developed and optimized for manifold manufacturing to create hot runner systems in various volumetric sizes and cavity pitches with inherent advantages for melt distribution, even with challenging applications.

Diffusion bonding is a solid-state diffusion process that causes the atoms of adjoining steel plates to intersperse and become one. The basic procedure involves heating the plates to just below their yield point and applying high pressure to the mated plates in a vacuum environment. Once the process is completed, the result is the creation of a single piece, multi-level manifold. Diffusion bonding does not require the adjoining plates to be soldered, brazed or welded. Plus, there are no films, pastes or bonding elements used. Instead, only the adjoining plates are in direct contact during the process.

> Diffusion bonding offers more design freedom to geometrically balance melt flow to each cavity and minimize pressure drop throughout the channel layout.

Traditionally, manifolds are manufactured using gun-drilled rectilinear channels that interconnect within a steel block. However, when diffusion bonding is employed, the melt channels can be contoured and shaped to provide an optimized flow path to each cavity. The melt channel patterns are machined directly on the surfaces of multiple adjoining steel plates, mirror imaged and precisely mated in preparation for the diffusion-bonding process.

Diffusion bonding allows engineers to be creative when balancing the melt flow paths to each cavity. The process facilitates smooth, level transitions, eliminates sharp corners, edges and dead spots, minimizes pressure drop throughout the channel layout and allows the flow paths to be polished. Diffusion bonding also removes the need for end plugs, which eliminates the risk of leakage, and simplifies the entire channel layout, providing more space for bolt locations to significantly improve rigidity and durability.

Manifolds using diffusion bonding can reduce color changes over time, cavity-to-cavity weight variations, peak injection pressures (higher achievable injection rates) melt degradation/AA generation (PET) and resin flow stress of sensitive materials. MMT

CONTRIBUTOR

Rick Unterlander is general manager for Yudo ValuePro Lab Canada.

FOR MORE INFORMATION

YUDO, Inc. / 734-744-8120 / yudo.com

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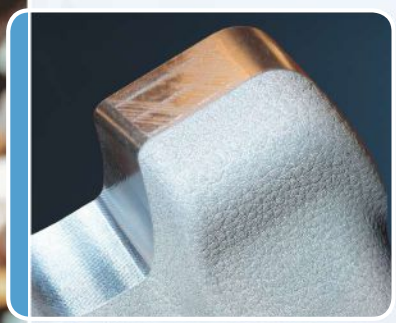

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