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April 2019

# Conformal Cooling:

In Conversation With N Prabakaran, Managing Director, DIETECH India (P) Ltd

**Expert Article** The Emergence of Conformal Cooling

**Case Study** Conformal Cooling helps Bastech reduce cycle time by 22%



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18 " Editio

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# EDITORIAL



# Cooling effect

elcome I am su charted ending and op

elcome to the new financial year, 2019-20. As you are reading this, I am sure you must have analysed the year that passed by and charted out plans for the new financial year. Backed by the positive ending of the last financial year, the new one comes with hope and opportunities.

With my extensive engagement with tool makers, I have managed to underline the top trends that will impact the industry in the coming financial year. These trends are— increase in localisation among the automotive OEMs; rise in the usage of additive manufacturing and we will see a gradual shift from prototype to production; technology adoption will grow & industrial IoT is here to stay; tool exports from India could increase and we might witness some big tool rooms from other countries to set shop in India.

With the above points we can look forward to several opportunities.

Coming back to this edition of TAGMA Times, let's just say we found the perfect topic for this scorching season. We can all feel the heat; however, we do have a cool technology to talk about—Conformal cooling.

Conformal cooling is being regarded as the Next Big Thing in the tooling industry for its unique value proposition. Mould cooling is one of the most important process that also takes long time. Conformal cooling channels manufactured by DMLS method not only provide uniformity in cooling process, but also saves time. We have some interesting articles and case studies in this edition that talks about the emergence of conformal cooling and its benefits.

Do write to us about your views and more such interesting topics you would want to read about.

Happy summers!

Thanks

Nishant Kashyap Editor nishant@antechmedia.in

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# Automotive Update

#### Passenger vehicle sales in India likely to reach 5 million units in FY23

**THE** passenger vehicle (PV) market in India is likely to reach a sales figure of about five million units in FY 2023 from 3.3 million units in FY18 thereby clocking a compounded annual growth rate (CAGR) 7.7 per cent, according to a recent ASSOCHAM-Roland Berger joint study.

"Stronger preference for SUVs (sports utility vehicles) and crossover models is expected to continue in future as well leading to a CAGR of 12 per cent in FY18-23," it said. The study titled, 'Moving towards greener transportation,' was conducted by The Associated Chambers of Commerce and Industry of India (ASSOCHAM) along with global strategy consulting firm Roland Berger.

The report, however, noted that significant growth potential exists in terms of penetration of four-wheel vehicles in India which is much lower when compared to global economies such as USA and China.

The study also noted that domestic sales of commercial vehicles in India is expected to cross one million units by FY23 from 832,000 units in FY18 thereby clocking a CAGR of 5.6 per cent.



"Implementation of GST will consolidate manufacturing operations resulting in faster turnaround times and an overhaul of the distribution system to a hub-and spoke model," it said.

The report further said that stricter enforcement of overloading ban, implementation of scrappage policy from April 2020, and GST are all expected to positively impact M&HCV market demand. Noting that growth is expected in both agricultural as well as construction machinery segment due to increasing mechanization trends, the report said that off-highway machinery domestic sales are likely to reach 870,000 units by 2022 from 749,000 in 2017 thereby clocking a CAGR of about three per cent. Driven by expectations of normal monsoons, increased minimum support prices (MSP) and farm loan waivers in states such as UP, Punjab, Maharashtra and Karnataka, the ASSOCHAM-Roland Berger study expects agriculture tractor segment is expected to grow at a CAGR of 2.8 per cent in 2017-22.

Terming the government's intention to move from fossil fuel to clean fuel as a positive step towards positioning India

at the forefront of global quest for clean mobility, the report said that the onus is not on the government alone.

"Auto-component suppliers need to swiftly catch up on green technology and business readiness by technology acquisitions, collaborations and capability demonstrations," it suggested adding that they should de-risk their current businesses by pivoting towards future-ready opportunities that ideally leverage their current capabilities.

The report further said that original equipment manufacturers (OEMs) in turn need to keep a nimble powertrain strategy with focus on green and work together as well as with the government to develop capabilities and roadmaps.

#### Royal Enfield to invest Rs 700 crore in 2019-20

**EICHER** Motors recently announced Rs 700 crore capital expenditure plan for Royal Enfield in the current financial year. The capex will be used for the construction work of the Technology Centre, Phase-2 of the Vallam Vadagal plant in Tamil Nadu and towards the development of new platforms and products. Also, for 2019-20, Royal Enfield plans a production of 9,50,000 motorcycles, Eicher Motors said in a statement.

"This year Royal Enfield will focus on the upcoming transition to the BS-VI emission norms along with strengthening our product development capabilities and working towards new global platforms," said Siddhartha Lal MD & CEO, Eicher Motors.The second phase of our Vallam Vadagal plant near Chennai, Tamil Nadu is progressing well and is expected to commence commercial production in the second half of this financial year. The construction of the Technology Centre in Chennai is also nearing its completion, he added. "With a wide distribution network in India, growing international presence and building state-of-the-art capabilities in product development, Royal Enfield is well on its way to grow the middleweight motorcycle segment globally in the coming years," Lal said. In FY 2018-19, Royal Enfield announced formation of its wholly-owned subsidiary in Thailand. To further strengthen its presence in the ASEAN region, it recently announced its upcoming assembly operations in Thailand, its first outside of India.





#### ZF Wins Major Business for New 8-Speed Automatic Transmission



**ZF** Friedrichshafen AG has received a customer order for its enhanced 8-speed automatic transmission with a double digit billion value. The business is planned to run over a period of several years. The latest version of ZF's 8-speed transmission – a technology which has been production since 2009 has been optimized by integrating an electric drive. This also includes a hybrid variant.

The new transmission generation will start series production in 2022 at ZF's plant in Saarbrücken, the lead production facility for ZF's automatic passenger car transmissions. The company also plans to start production of the technology at further locations including the USA and China in the future. "This business win is the largest single order in the history of ZF," said ZF's CEO Wolf-Henning Scheider. "When it comes to the electrification of passenger cars, in addition to pure electric drives, it confirms our strategy to focus on plug-in hybrids as an every-day solution and to develop attractive products in these areas."

# Automotive Update

#### Bosch's Two-Wheeler & Powersports Business Unit sees growth in India

BOSCH'S Two-Wheeler & Powersports Business Unit is continuing the ride towards the global target of one billion euros of sales in 2020, generated by assistance, powertrain, electrification, and connectivity systems. Bosch's vision is to make the mobility of the future accident-free, stress-free, and nearly emissions-free - and this goes for the continuously growing motorcycle market as well. Based on Freedonia, the global demand for two wheelers is forecasted to grow annually by more than 4% from 2017 to 2022, reaching 122 million bikes by 2022. Major growth of the Two-Wheeler & Powersports business is forecasted in India where Bosch supplies market-specific motorcycle safety and powertrain solutions to comply with regulations as well as local market trends. "The two wheeler landscape today is undergoing many changes as industry players look to innovate their service offerings. As a key player in the two wheeler space, Bosch has always endeavored to provide services that integrate cutting-edge technology with the company's inherent focus on functionality and efficiency," says Geoff Liersch, Head of Two-Wheeler & Powersports Business Unit.

# Second half sees subduded growth across all segments of vehicles year ends with mere 5% overall growth

**Production:** The industry produced a total 30,915,420 vehicles including passenger vehicles, commercial vehicles, three wheelers, two wheelers and quadricycle in April-March 2019 as against 29,094,447 in April-March 2018, registering a growth of 6.26 percent over the same period last year.

**Domestic Sales:** The sale of Passenger Vehicles grew by 2.70 percent in April-March 2019 over the same period last year. Within the Passenger Vehicles, the sales of Passenger Cars, Utility Vehicle & Vans grew by 2.05 percent, 2.08 percent and 13.10 percent respectively in April-March 2019 over the same period last year.

The overall Commercial Vehicles segment registered a growth of 17.55 percent in April- March 2019 as compared to the same period last year. Medium & Heavy Commercial Vehicles (M&HCVs) increased by 14.66 percent and Light Commercial Vehicles grew by 19.46 percent in April-March 2019 over the same period last year. Three Wheelers sales increased by 10.27 percent in April-March 2019 over the same period last year. Within the Three Wheelers, Passenger Carrier sales registered a growth of 10.62 percent and Goods Carrier grew by 8.75 percent in April-March 2019 over April-March 2018.

Two Wheelers sales registered a growth at 4.86 percent in April-March 2019 over April-March 2018. Within the Two Wheelers segment, Scooters declined by (-) 0.27 percent, whereas Motorcycles and Mopeds grew by 7.76 percent and 2.41 percent respectively in April-March 2019 over April-March 2018.

**Exports:** In April-March 2019, overall automobile exports grew by 14.50 percent. While Passenger Vehicles exports declined by (-) 9.64 percent, Commercial Vehicles, Three Wheelers and Two Wheelers registered a growth of 3.17 percent, 49.00 percent and 16.55 percent respectively in April-March 2019 over the same period last year.



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# Technology Update

#### SIGMASOFT® identifies ideal parts and injection processes virtually

SIGMA Engineering GmbH from Aachen, Germany, introduces its SIGMASOFT® Virtual Molding software and the enclosed Autonomous Optimization technology at various exhibitions. The Autonomous Optimization and its included possibility to conduct virtual Design of Experiments (DoE) help the user to optimize their parts, moulds and processes even easier than before.

SIGMASOFT<sup>®</sup> works as a virtual injection moulding machine and allows the user to test different set-ups and new concepts without risk on the computer. With the now included possibility to conduct a virtual DoE, different geometry and process parameter variations can be compared and evaluated in one single calculation. In this way, the user can easily answer various questions on the part and process upfront during the design stage without conducting tests on an injection molding machine.

A common type of virtual DoE,



regardless of the used polymer, is the determination of the ideal injection point for the part. For fiber-reinforced thermoplastic materials, the injection point has a main influence on the resulting fiber-orientation inside the part. Depending on the flow path of the melt, the fibers show a varying orientation inside the part. This leads to different mechanical properties. By determining the best injection point, the user can considerably improve the fiber-orientation and thus the mechanical properties of the part.

For rubber and LSR (liquid silicone rubber) materials, the required injection

pressure is mainly depending on the gating system. To optimize the pressure loss and the whole gating system, a virtual DoE, which evaluates different positions and number of gates, is a straightforward approach. At the same time, the risk of potential air entrapments is rated. Based on this first evaluation the ideal configuration of the cold runner and the optimum filling time can be determined. In the further course of the project, the design of the

course of the project, the design of the whole mould and its concept for the heating cartridges is supported by the software.

With the possibility to conduct a virtual DoE the user can rely on SIGMASOFT<sup>®</sup> Virtual Moulding during the design of parts, moulds and processes. The software provides an easy to use tool to answer questions arising on topics like ideal injection point, temperature layout of the mould or optimum cycle time. Thus, it enables the user to make decisions on a sound basis and helps to reduce trials on the machine and iterations for the mould significantly.

#### hyperMILL 2019.2 at Moulding Expo

**OPEN** MIND Technologies AG is exhibiting at the Moulding Expo in Stuttgart. OPEN MIND will be showcasing hyperMILL® 2019.2, the latest version of its high-performance complete CAM solution as well as upgrades to the hyperMILL® MAXX Machining performance package that includes innovative strategies for HPC machining. From 21–24 May 2019, fair visitors can find all the latest news relating to the CAD/CAM and these exciting innovations on Stand B31 in Hall 5.

Open Mind develops two hyperMILL® releases each year in order to promptly incorporate the latest requirements and



trends in tool and mold making into the software. hyperMILL® Version 2019.2 delivers a number of new features and upgrades for 3D, 5-axis, and mill/turn machining as well as for feature and macro technology. These include the newly integrated 'Surface Precision Mode' and 'Smooth Overlap' options for 3D finishing that make it possible to create ultra-smooth surfaces.

Turning has also been added as a new machining feature to the hyperMILL® MAXX Machining performance package. This provides users with turning strategies for HPC machining to go along with innovative milling strategies. 'High Performance Turning' ensures significant time savings and roughing

operations are possible whilst reducing wear and stress on both cutting tools and machine tools. The perfect pocketing technology is also now included in the hyperMILL® MAXX Machining package. This technology fits pockets perfectly into the area to be machined and optimizes toolpaths for high-feed milling.



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# Technology Update

#### CoreTech System Releases Moldex3D R17

**CORETECH** System (Moldex3D) recently announced the release of Moldex3D R17, the nextgeneration plastics molding simulation solutions designed to enable organizations around the globe to realize smart manufacturing through digital transformation. The latest release of Moldex3D provides more comprehensive and realistic simulations to help users close the gap between the physical and virtual worlds. The new user interface and the unified simulation workflow allow users to gain deeper insights into product performance faster, accelerating the decision-making process. In addition, to tackle the ever-growing demand for lightweight components in the automotive and aerospace sectors, Moldex3D R17 offers significant advancements in composites simulation solutions to meet various manufacturing needs.

"The release of R17 marks a major milestone for Moldex3D. The more powerful physicalvirtual integration capability and more timely design insights will largely benefit designers, tool makers and CAE engineers to help them further advance smart manufacturing capabilities and ultimately enhance their global competitiveness," said Venny Yang, President, CoreTech System (Moldex3D).

Major highlights of Moldex3D R17 include: Machine Response and Material Compressibility Effect under Real-world Conditions Aiming to bring simulation one step closer to real-world manufacturing, Moldex3D R17 introduces new and enhanced capabilities for integrating physical molding into the virtual world, enabling the simulation software to better capture crucial information by providing crucial data, including maximum pressure drop, total flow rate and heat dissipation. Through seamless integration between the physical and the virtual worlds, engineers can fully leverage simulation data to make more informed decisions.



from the physical world. Moldex3D R17 allows users to consider the dynamic machine response of an injection molding machine to ensure that the optimized processing conditions obtained from the analysis can be directly applied on the shop floor, bridging the gap between simulation and manufacturing. In addition to machine characteristics, Moldex3D's barrel compression functionality provides a more realistic prediction of material behaviors by simulating the actual compression behavior of melts inside the barrel and the nozzle, which empowers engineers to take into account the effect of material compressibility when injecting into the cavity, generating a more accurate injection pressure prediction.

Moldex3D Cooling analysis with R17 delivers the capability to help users better evaluate the performance of mold temperature controllers

#### Groundbreaking Composites Simulation Technology to Achieve Lightweighting Goals

Simulation plays a major role in helping manufacturers easily transition to lightweight materials and manufacturing processes. In the latest release, Moldex3D continues its technology leadership in fiber composites simulation with the introduction of Flow-Fiber Coupling analysis, which empowers engineers to more accurately capture the anisotropic flow behavior induced by fiber orientation. Composite components that deal with high concentration of fibers and demand high accuracy will greatly benefit from this novel coupling method. Moldex3D Fiber orientation analysis with R17 now supports a new filler type—flat fibers to enable greater design freedom and help achieve better mechanical properties and improved dimensional stability.

For advanced lightweight manufacturing processes, the Moldex3D Material Lab provides comprehensive material testing services for characterizing critical material parameters, including the expansion ratio of polyurethane foam. Moldex3D R17 enables users to further predict the expansion ratio in PU Chemical Foaming analysis to more accurately predict foam height and shape for creating better polyurethane molded parts. Also available in R17 is an improved RTM Wizard, which streamlines the mesh preparation process, increasing simulation productivity.

#### A Unified Platform for Faster, Deeper Insights

Moldex3D has been striving to enhance usability to help users translate simulation data into useful product insights faster and easier. Moldex3D R17 Studio seamlessly integrates all simulation processes on a single, unified platform, and greatly enhances the way users can view and interact with a model. For example, users can now use Measurement and Scale tools in Studio to directly measure shrinkage values and make instant design changes to compensate for shrinkage. Moreover, with the new postprocessing and visualization functionality along with faster rendering performance in R17, engineers can now quickly unlock the hidden insights behind the model, mitigating manufacturing risks and accelerating product development.

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# **USBCO** Steels Private Limited Asia Engineering Supply Stores Pvt. Ltd.



### HOT WORK DIE STEELS

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# Conformal Cooling: Need of The Hour

Conformal Cooling is being referred to as the next big thing in the tooling industry. With its's unique value proposition such as saving time in cooling process and providing uniformity in cooling, it has witnessed an increase in demand. However, building conformal cooling channel is no easy task and it looks like additive manufacturing (AM) is the only option. To find out more, I speak with two industry experts Jayesh M. Rathod, Sr. General Manager & Head, Diecasting Engineering, Godrej Tooling and Arpit Sahu, Director, **Objectify** Technologies to understand the fundamentals of conformal cooling, benefits of the process, and the future outlook.



#### Nishant Kashyap

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p until a decade ago, cooling channels for moulds were (and in some parts, still are) drilled in secondary machining operations, and they followed straight lines. If more cooling was needed than a simple channel could provide, toolmakers create an insert that had channels with baffles or helix baffles. In rare cases where more intricate cooling channels were unavoidable, toolmakers split the mould into segments, milled matching half-channels into the segments, and solder the segments together to produce channels that don't follow straight lines. The milling is costly, time consuming and the mould life was at stake because the solder often deteriorates over time.

Conformal cooling is a promising alternative and is fast gaining acceptance. Cooling channels follow with the part's contours to facilitate faster and more uniform cooling. Until recently this simple concept has been difficult to execute within mould making communities. Some of the geometries required in conformal cooling are impossible with traditional machining.

#### Understanding Injection Moulding

Injection moulding is a process by which plastic pellets are melted and then forced into a mould, where the material takes its final shape. Once the cavity is filled, coolant disperses through cooling lanes within the mould in order to bring parts down to an appropriate dispensing temperature. Part cooling is an important part of the process to produce quality parts but consumes 50% to 80% of the cycle time per build.

Conventional cooling paths are machined in straight lines. A coolant flows through the channels at a given temperature and pressure, optimizing cycle time and part quality. This method produces flawed results because straight paths cannot provide consistent cooling throughout the mould cavity. Cooling rates for a given mould segment depends, in part, on its proximity to cooling channels. Nonuniform cooling across parts leads to longer cycle times, uneven cooling, warpage, and scrap.

Conformal cooling is also a proven strategy for reducing cycle time, in some cases as much as 70%. Until recently, however, the manufacturing techniques used to create conformal channels offered limited design options and were too expensive to use in most applications. Presently, additive manufacturing techniques are cutting Conformal cooling technique will be widely used in future for injection moulds, die casting dies and other tools of moulding process due to feasibility of making the effective cooling channels"



Jayesh M. Rathod Sr. General Manager & Head, Diecasting Engineering, Godrej Tooling

down these costs, enabling the industry to experiment more freely.

#### What is Conformal Cooling?

Growing numbers of injection moulders are discovering the advantages of using conformal cooling channels that follow the shape of the cavity and core, reach hot spots, and promote temperature uniformity in the plastic materials being moulded. These moulders are seeing striking results which include shortened cycle times, improved plastic part quality, and cost reductions.

The concept of conformal cooling is not new. It came about because it solves a difficult problem: removing heat uniformly from parts with complex geometries. In these parts, placing cooling channels near corners and large, cored-out features can be difficult or impossible with conventional milling and drilling. Conformal cooling inserts feature curved channels that wrap around the part in an even distribution, much like the tubes of an old-fashioned radiator. These channels can easily reach the inaccessible regions of a part while easily



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Thus an exponential drop in cooling time helps in reducing time, cost and warpage of the Production Cycle meanwhile increasing Production Rate. It's a win-win for all.

accommodating ejector pins, attachment screws and other features, and remaining a consistent distance from the surface of the mould.

The only problem was cost. Creating the moulds using vacuum brazing or similar techniques was too expensive to justify the benefit. Recently, however, direct metal laser sintering (DMLS), also known as powder bed fusion or laser sintering, has changed the equation.

This additive manufacturing technique fires a laser into a bed of powdered metal, hardening the material, layer by layer, to gradually create a final structure from a CAD file. DMLS can build virtually any structure and the process is extremely cost effective. In other words, DMLS allows you to design conformal cooling inserts without the normal concerns about drillability, making them a much more attractive option for mould making shops.

According to Jayesh M. Rathod, Sr. General Manager & Head, Diecasting Engineering, Godrej Tooling, "In die casting, dies and plastic injection moulds maintaining thermal condition is very critical to achieve the required quality of products. Conventionally, thermal condition in dies and moulds is achieved by circulating cooling media





Arpit Sahu Director, Objectify Technologies through drilled holes. However, some product features form very thin and intricate sections wherein these cooling holes are not possible to make by conventional machining. In such applications, 3D printing technology comes to the rescue and these cooling features are made through additive manufacturing technology. These cooling features thus formed is called conformal cooling."

#### **Benefits of Conformal Cooling**

Conformal cooling channels allow the coolant to access all part locations uniformly, making the cooling process efficient and consistent. It is not always possible to reach all part areas with conventional methods. Depending on how much of the volume is inaccessible, the cycle time can increase significantly.

"Use of conformal cooling improves the thermal efficiency of the tool drastically which results in reducing the production cycle time. Also, it helps to improve the part quality due to reduction in shrinkage porosity, reduction in soldering problems, and reduction in part warpage. Due to uniform internal cooling by conformal cooling, there is less thermal shock to the tool material which helps to improve the tool life. Overall benefit will be reduction in per piece cost of component for mass production components," says Rathod.

Arpit Sahu, Director, Objectify Technologies adds, "The idea of conformal cooling is simple. It's just like centralised cooling but instead of a 'building', it is centralised cooling for the mould. Almost 50% of the entire cycle time taken during the production cycle is due to the cooling of the moulds. To counter this trivial problem conformal cooling does a very good job in reducing the time taken."

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#### Why AM is the Only Option?

The emergence of AM has increased the availability of conformal cooling to mould designers. Using direct metal laser sintering (DMLS) or other additive manufacturing techniques, complex cooling channels can be optimised during the mould design phase rather than post-processed at suboptimal locations.

According to Mr Rathod, "Maraging steel powder is widely used for additive manufacturing using the DMLS to make the inserts with conformal cooling for die casting dies and injection moulds. These 3D printed inserts are heat treated to maintain hardness

of 52-54 HRc . Finish machining operation is required after the heat treatment to maintain the critical dimensions. We have preference for DMLS method as it has been used by us."

Adds Mr Sahu, "3D printing of conformal cooling channels seems to be one of the most promising one till date. With major implications in the production of parts in a large scale with the



help of die and moulds, conformal cooling channels are by far the biggest revolution yet to bestow its potential. Proven to increase the production rate from 25% – 60% (depending on the mould makers), it reduces warpage, time of production and cost of production."

#### **Future Outlook**

With the growing demand for higher productivity and speed, conformal cooling seems to be a great news for the tooling fraternity. Conformal cooling solves the overdue challenge of tooling industry that is to provide uniform cooling channels and reduce time and enhance the life of the mould. Conformal cooling coupled with AM holds great future and will continue to enjoy wide acceptance in the industry. Companies who are not still practising the conventional cooling methods will sooner or later switch to the process.

"Conformal cooling technique will be widely used in future for injection moulds, die casting dies and other tools of moulding process due to feasibility of making the effective cooling channels. At present, due to high cost factor at tool making stage, tool makers are not ready to invest in this technology. But looking at the total benefits due to conformal cooling, industry will widely start using this technology to improve on all PQCD parameters," concludes Mr Rathod. ~

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# "OEMs should work closely with tooling suppliers"

"The Indian die mould makers need to be aware that their responsibility doesn't end on providing a good quality mould. They should also ensure smooth functioning of the mould for the benefit of the end customer. Unless this support is extended, the moulds being supplied will not be viable for the end customer," says N Prabakaran, Managing Director, DIETECH India (P) Limited.

#### Nishant Kashyap

#### Q Please take us through your entrepreneurial journey...

I started my entrepreneurial journey in 1981 along with my college friends. We were trying to make tools for PDC with limited contacts and exposure to the industry. Though we were unsuccessful, it was a learning experience. Later, I joined TVS group as a die maintenance engineer at SCL, Padi. The systems followed at TVS and their focus on developing skilled man power was something I admired. During this time, I also realised that die mould industry was not as developed in India and we were dependent on imported tools. This led to the foundation of Dietech India in 1995. We started by servicing

# In conversation With

imported tooling and gradually moved towards indigenous manufacturing of GDC, LPDC (Gravity Die-Casting, Low-Pressure Die-Casting) tools.

Currently, we manufacture one tool per day on an average and a large portion of our business is in the HPDC (High-Pressure Die-Casting) market given the high-volume of demand from the automotive segment. As we aimed to become a system driven company, we invested our time and energy creating an in-house ERP system to handle the complex activities involved in die manufacturing. Our other key focus area has been on design automation and developing skilled man power. We were always at the forefront when it comes to adopting new technology and practices including 3D scanning-GOM (Geometrical Optical Measurement), 5-axis machining for deep cavity moulds (Eg. Transmission Case Die) for four wheeler, automated mould base design software (AMB), and flow simulations of gating systems (Flow-3D).

I have faced several challenges through this journey including retention of skilled man-power, scaling of our manufacturing plant (incl. setup of our manufacturing plant in 2011 at SIPCOT), and managing capital investments given the scale of our growth. But, our customer-oriented approach and service support has helped us stay ahead.

# **Q** Tell us about the current state of Indian die mould industry...

The Indian die mould industry is on the growth path. There are ample opportunities as Indian tool rooms are roughly catering only to one third of the overall requirement. In the recent years there has been a push towards manufacturing die mould in India by customers including OEMs and Tier 1 part suppliers but challenges remain in terms of costing and delivery.

#### Q A significant number of tools are still imported, why?

The die mould manufacturers for aluminium die caster parts are only a handful on the scale that OEM are content with. This is the prime reason most of the moulds for aluminium die-casting are being imported from China, Taiwan, Thailand etc., We do not have enough good quality tool rooms in India that have design and technical expertise to deliver high quality moulds. In comparison, an area like Ningbo in China, has roughly 20 large tools rooms and apparently 1000 SME in this field. The Indian die mould industry is on the growth path. There are ample opportunities as Indian tool rooms are roughly catering only to one third of the overall requirement. In the recent years there has been a push towards manufacturing die mould in India by customers including OEMs and Tier 1 part supplier"

> The challenges, as highlighted earlier, are delivery lead time and costing which according to me can be overcome by the use of technology. However, the investment for new technology is often not supported by customers who generally look at India as only a low-cost market. Also, the lack of skilled man-power affects the quality of workmanship. To overcome these challenges, OEM's need to hand hold and invest in their tool room partners, not only to meet their current demands but also meet the future requirements.

# **Q** What are the factors driving the demand for the Indian die mould suppliers?

India is a lucrative market especially for the automotive players. The industry has also witnessed consistent growth in the past decade, driving the demand of die mould. Further, due to its nature, the casting and foundry industry is not encouraged in the developed countries, so they outsource such products/work to countries like India and China. A significant portion of business especially in aluminium casting is being developed in India. But there are certain challenges that we have to address like development of skilled man power, enhancing processes and practices to meet global standards, adopting latest technologies and practices, providing high quality moulds with defined processes, and FMEA analysis with simulation data to incorporate in design.

#### Q A large number of Indian tool rooms are SMEs, what are the challenges they face?

Some of the main challenges that these tool rooms face are high interest rates of capitals, unavailability of skilled manpower, no surety on business from customers, poor costing strategies by SME's coupled with poor payment cycles by customers, and insufficient investment or infrastructure support from the government.

# **Q** How can the government help the Indian die mould industry?

The government can help by providing financial

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aid in reasonable interest rates (3-4%). Also, infrastructure support from government in terms of procurement of land, power supply etc. can help the industry. Further, policy decisions, on the import of die mould could be reviewed to safeguard the interest of Indian die mould industry.

# **Q** How can we enhance the collaboration between OEMs and tooling suppliers?

OEMs should work closely with tooling suppliers. It will help them understand and achieve the OEM prescribed standards. The OEMs can also transfer their technical expertise to tool rooms through joint exercises and also provide some guarantee on business which would enhance investments in new technologies by tooling suppliers. With technology and technical expertise tool rooms can achieve speed and accuracy. Investment and customer support in terms of costing on good quality tools will further help build collaboration.

# **Q** What are the parameters to keep in mind before choosing right materials for mould base?

For aluminium die-casting application, more than new material grade, the quality of the pouring (on castings) and heat treatment (HT) on blocks determines the die life. With respect to hot work die steel on cavity, high quality material contribute only a portion of the guarantee die life, the rest lies in the HT process. In Hot Work Steel, there are ESR (Electro-Slag Refining) and VMR (Vacuum Melt Refining) grade steel, give high purity and good composition controlled steel. However, now the emphasis has moved to high toughness steel which has good control of composition as well as distribution of carbides. In addition, hot work steels are also being designed by simulation for compositions tuned to suit specific applications (Eg.E40K Thermodur). The challenge, however, still lies in effective heat treatment of inserts which lacks scale and expertise in India when compared to our counterparts.

The reuse of mould bases in die-casting mould is often promoted by casting rather than blocks to save material and cost. Also, the replacement of cavity parts in running mould bases is also gaining momentum. The material used for holder blocks has upgraded from conventional EN8 (cast), P20 (block) to FCD 55 (cast), depending on customer demand.

# In conversation With

# **Q** Any suggestions for the Indian die mould makers...

They must understand that the success of the die lies in its performance at the die caster end. At times, die-casters need technical and service support for commissioning of dies, maintenance of dies and sometimes even technical support on fine tuning the die-casting machine to mate the die to ensure smooth production. The Indian die mould makers need to be aware that their responsibility doesn't end on providing a good quality mould. They should also ensure smooth functioning of the mould for the benefit of the end customer. Unless this support is extended, the moulds being supplied will not be viable for the end customer. This service support will be key factor that can bring the imported die market to India tool rooms.

# **Q** Any tips or suggestions for the budding entrepreneurs...

Entrepreneurship is probably the hardest profession to kick start your career. More than your vision, talent, hard work, and people management skill, it will be your attitude towards problems/ challenges that will determine your success. The ability to persevere in hard times and to be able to carry people along during hardships is perhaps the defining aspect of entrepreneurship. India, as young nation will require aspiring entrepreneurs to blossom, but the support structure needs to be established to give them guidance from both industry professionals and the government.

#### **Q** Future of Indian tooling industry...

With several disruptions anticipated in the automotive sector including EV's, growth prospects in defence and aerospace, disruptive technologies like additive manufacturing, the Indian tooling industry can look forward to a challenging but promising future. The challenges can be met by upgrading technology, adopting the latest practices, training and retaining skilled workforce, taking up challenges, and by rightly understanding the customer's requirement.

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# Policy Watch

# Safety norms and BS VI transition will drive auto ancillaries revenue growth in FY2020



igher content per vehicle to support new emission and safety requirement is expected to drive demand for auto ancillaries despite relatively muted auto original equipment manufacturer (OEM) demand. As per ICRA's note on the auto component industry, the weighted average growth in demand for auto components from OEMs is estimated at 9-10% in FY2019 (as against 9.5% in FY2018) supported by strong commercial vehicle (CV) volumes. The growth for FY2020 is likely to be around 8-9% Y-o-Y. This is taking into consideration the likely automobile volume growth of 8-9% during FY2019 and ~7% during in FY2020, as against 14.5% growth during FY2018 and 5.4% during FY2017.

In the 11M FY2019, automotive OE production volumes grew by 8.8%. Says Mr. Subrata Ray, Senior Group Vice President, ICRA, "With pre-GST inventory destocking leading to sharp contraction in auto Original equipment manufacturer (OEM) sales volumes during April-July 2017, the base effect translated into volume growth across several OE segments and in the replacement market during 11M FY2019. However, there has been a lull in all segments, except tractors since Nov 2018. Even in tractors, while production has been growing at a healthy pace, sales have been muted since Jan 2019."

In the aftermarket, sales were impacted in FY2018 because of GST-related inventory destocking in Q1 FY2018 and initial GST implementation related uncertainties in Q2 FY2018. Demand picked up in Aug/Sep 2018, with a sharp revival from Q4 FY2018 onwards. While aftermarket sales witnessed double-digit growth on Y-o-Y basis in H1 FY2019 (excluding tyres and batteries), ICRA research estimates 0-2% growth during Q3FY2019 due to the high base effect of Q3 FY2018 and tightened financing environment. Collection cycle in the replacement segment has also stretched with the on-going tightness in liquidity.

The domestic auto-component industry has also likely to be impacted by global automobile demand. The global automotive outlook is relatively muted. The US Class 8 truck retail sales exhibited strong growth of 37% in CY2018. While this growth momentum is likely to continue in CY2019, US class 8 Truck order book has been dropping since Nov 2018, after a record 4,90,000 units of orders in CY2018, and this would impact sales in CY2020, given the lead time to execution. European passenger vehicle (PV) demand too is likely to be muted for CY2019 following decline in PV registrations since September 2018 post mandatory compliance with new emission standards (Worldwide Harmonised Light Vehicle Test Procedure) and Brexit-related uncertainties.

The upswing in commodity prices over the last few quarters is reflected in ICRA's small car cost index breaching the previous peak (FY2015) in FY2018 and inching up further in 9M FY2019. The OEM price pass-through clause which several tier-1 ancillaries enjoy, and operating leverage benefits from higher volumes has mitigated the impact on operating margins to an extent, although the current softening in commodity prices is hampering pass-throughs. Overall, ICRA expects commodity prices to moderate marginally during FY2020, easing margin pressure for the industry.

In terms of revenue growth for Q3 FY2019 for ICRA's industry sample (48 auto ancillaries), the same showed continued traction growing by 11.4%. However, this was the lowest quarterly Y-o-Y growth since Q2 FY2018. For 9M FY2019, the industry

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# Policy Watch

![](_page_35_Picture_1.jpeg)

witnessed a topline growth of 18.2% Y-o-Y, supported by the strong volume growth in Q1 and Q2 FY2019 and commodity pass increases. Operating profit margins however contracted by 120 bps Y-o-Y to 12.9% during Q3 FY2019, impacted by inadequate pass through of crude price hikes, INR depreciation, and commodity price increases, even as auto component companies benefitted from high volume growth and consequent operating leverage benefits. For 9M FY2019, the OPM of ICRA's sample increased marginally by 10 bps Y-o-Y to 13.5%, predominantly aided by margin improvement in tyre companies (which had a dull Q1 FY2018 due to high rubber prices and GST implementation).

Adds Mr. Ray, "ICRA expects revenues for the industry to grow by 10-11% in FY2020, driven by increased content per vehicle, supported by the transition to BS VI and mandatory safety norms and despite muted volume growth for most automotive segments during FY2020. Operating margins will remain in the 13.75%- 14.25% range in the medium term. Capex was high at 6-7% of operating income during the past three years (FY16-18); this trend is expected to continue during FY19-23 also, driven by investment in capacity creation, emission and safety related products, powertrain electrification and localisation of the same and non-core investments to support the defence, aerospace and engineering industry."

Robust demand of the past year has led to a sharp increase in capacity utilization during the latter part of FY18, triggering capex. While the recent softness in demand has led to a cautious approach on capex in the immediate term, ICRA research is tracking capex worth Rs. 31,000 crore across 45 auto component majors to be executed over the next three years (FY19-23), as against Rs. 24,800 crores (for the same sample) over the past three years (FY16-18). *«* 

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# Expert Blog

# The Emergence of Conformal Cooling

Cooling time in moulds processing takes one of the highest time and directly impact on overall efficiency of the mould. Since the emergence of Conformal Cooling the Mould Designer & Mold Flow Engineer will have flexible ways to design cooling channel. This solution provides opportunity for Mould Designer to think without limiting of hereditary way of manufacturing cooling channels. Read on to know the fundamentals of conformal cooling, its benefits and how it is better option then the conventional ones.

![](_page_37_Picture_3.jpeg)

onformal cooling is nothing but a cooling walkway which follows the shape of produced part (inside core or cavity of mould) to provide rapid and uniform cooling or sometimes even maintaining the temperature. While designing a mould/ die / insert, design engineer has to pay maximum attention to the temperature management. This temperature management is typically done by designing the mould in such a way that the material flow is quick, uniform and having optimal thickness.

Despite of design engineers best efforts this thermal management is not optimal. In other words the difference between the temperature at the inlet (of mould) and the temperature at the part filled last is high. This normally happens due to the part being intrinsic shapes, Cavity Layouts, Mechanism within moulds occupy more space resulting with limitation to design uniform cooling lines, which finally leads to higher cycle time, higher rejection rates, impact on mould life.

Image courtesy: "EOS GmbH

Conventional cooling lines have the limitation of the drilling process and these lines are typically straight channels within the mould. These cooling lines will not always effectively cool the mould as in case of difficult areas will tend to take more time to cool. This thus results to all the mentioned problems.

Conformal cooling channels on the other hand overcomes this large limitation. Conformal channels snake through the mould in a way such that they are within an optimal distance from the cavity / core / insert / part surface.

This helps the designer to manage the temperature of the mould, and give better results prior to actual manufacturing of the mould.

#### How conformal cooling works?

Conformal cooling works like a water jacket (in engine) around the cavity / core / insert which makes the shape of part / product helping the mould to cool in optimal time i.e neither quick nor slow.

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# Expert Blog

Cooling channels are created around the profile of part at the best distance to provide best temperature difference in the mould. This in turns reduces the cooling time in the overall cycle time and reduces in process rejection.

# Game changer in the tooling industry

While designing a mould, design engineer thinks from manufacturing point of view. Which means he thinks and answers from what can be made, instead of what is needed.

![](_page_38_Picture_4.jpeg)

3D printing / Direct Metal Laser Sintering (DMLS) technology gives a upper hand due to advantages like:

**Flexibility in design:** Conformal cooling channels are typically 3D printed, which makes it possible for cooling to reach the remotest corners of the mould. With conformal cooling, complex parts can be designed and realised.

**Cycle time reduction:** In most cases, conformal cooling can be designed to drastically reduce cycle time which is the single largest profitability parameter in injection moulding. In a setting where a mould goes through say 10 lakh shots, reduction of 30% cycle time means your moulding machines will be in operation for 30% lesser time, directly impacting bottom-line

- Fast to manufacture: The additive approach to manufacturing of such channels and inserts within a mould helps in realising the end result in just a matter of days, as opposed to weeks / months in a conventional setup
- Re-work: In most cases, conformal designs are simulated for flow, temperature uniformity and pressure uniformity. Only after the simulation yields satisfactory results, the part is 3D printed. This reduces the need for a trial and error approach which can be time consuming
- Part Defect & Mould life: Impacts on both these counts are positive, and high quality parts are achieved

#### Benefits over conventional cooling methods

Conventional cooling channels are typically drilled into the moulds, and as is with the drilling process, only straight holes can be made. This is inefficient in some cases as the cavities are rarely linear and desired cooling does not reach all areas of the cavity.

Conventional channels are designed typically after the design of the mould cavity takes place, and there is very little scope for modifying entry and exit points for the coolant channels within the mould. Clearly, the cavity design takes precedence over the cooling channel design.

This freedom of design is a key element in facilitating rapid and uniform cooling across the cavity. This directly impacts the cooling time which is a bulk of the cycle time in the injection moulding process.

Cases have been demonstrated where cooling times have been reduced by a staggering 50-70%. Besides cycle time, proper thermal management facilitated by the conformal nature of cooling drastically reduces defect rate, which also yields positive dividends to clients.

#### Importance of engineering analysis

Simulation helps in comparison of existing and improved conditions with conformal design with the forecasted results in terms of quality, cooling time reduction, overall cycle time.

![](_page_38_Figure_18.jpeg)

Scope of optimising cycle time by using disruptive technology like Conformal cooling

# Expert Blog

As simulation gives a predictive outcome, any design modifications can be made, either to the cavity or the cooling channels before moulds are put to production. Overall, this helps in delivering moulds to clients faster.

# Additive manufacturing and Conformal cooling

Without a doubt, Additive manufacturing has the potential to massively impact the tooling industry. With DMLS, you start with a thin metal powder layer.

Essentially the mould design is broken down into many segments and each segment is a layer of powder to begin with. This layer of powder is selectively sintered using a powerful laser, thereby solidifying only the required area. Then a new layer is applied over the previous layer, and the process repeats.

Also with new benefits like Layer Segmentation where different layer thicknesses can be used depending on internal intricacies, Hybrid Manufacturing where one can combine conventional manufacturing with DMLS to make perfect use of AM and many other notable inventions are opening new opportunities. Additive manufacturing makes it possible to realise parts which have very intricate and challenging internal features such as conformal channels. The extra effort in design is worth it as Additive manufacturing in itself takes very little time instead of Subtractive (conventional) manufacturing / material removal. The end results in most cases have significant cost and longevity benefits to our clients.

#### **Going forward**

The industry will shift towards this technology as it helps to drastically improve efficiencies. There will be a learning curve. As the design method is quite different to what engineers are currently used to, some skilling is required for design and simulation.

Using DMLS for conformal design of moulds / inserts is certainly here to stay, and we expect larger number of OEMs to adapt this feature within their moulds.

#### **About Author:**

![](_page_39_Picture_11.jpeg)

Guruprasad Puranmath is the Head of Tool Room at Mutual Engineering Pvt ltd. With about 15 years of experience, his experience counts from strong base of Design & Manufacturing with updated technology.

![](_page_39_Picture_13.jpeg)

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# KALYANI

World Class Precision Standard & Custom made Mould Bases and Inter- changeable Components for Plastic and Die Casting Moulds

![](_page_40_Picture_3.jpeg)

![](_page_40_Picture_4.jpeg)

![](_page_40_Picture_5.jpeg)

**KALYANI** Standard or Custom Made Mould Bases are Manufactured with The Highest Precision of Accuracy, exactly to the cuctomer's requirements with perfect interchangeability at any time.

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# **Buderus 2738 ISO-BM**

### For high quality Moulds where there is no compromise on quality

![](_page_41_Picture_2.jpeg)

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![](_page_42_Picture_2.jpeg)

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# Opinion & More

![](_page_43_Picture_1.jpeg)

Murlidhar Kadam, Jt Managing Director, TTB Tooling

# "The future of the Indian tooling Industry is bright"

"There are several factors favoring the Indian Tooling Industry and the biggest is the Government efforts to attract global players to manufacture in India", says Murlidhar Kadam, Jt Managing Director, TTB Tooling as he discussed about his journey as an entrepreneur, challenges and future prospects in the industry.

# **Q** Please tell us something about your company and its initial years...

I along with my Co-founders Satwant Singh & Aditya Mishra were working in a well-established organization and leading a settled life, but we felt our passion and interest towards the industry was slowly dying. We had to do something. All three of us had at least two decades of experience in setting up green field projects, running an organization, building and managing teams, knew the fundamentals of manufacturing, and had exposure to the global tooling scenario. We embarked upon the entrepreneurial journey in October 2015.

Initially, we lacked infrastructure but were confident about our capabilities. We started exploring our contacts in the industry and got some contracts for small tools. Initially, we started working from home, and were getting design and manufacturing done through known tool rooms. Gradually, we started handling complex jobs in competitive pricing which lead to the expansion of TTB.

In 2016, we sold our property to lease a land and incorporated die spotting press & other conventional machines with a skilled team of toolmakers. I strongly believe that the success of tool making business highly depends on skilled manpower. We were able to attract some of the skilled manpower in and around Pune and started taking more orders.

Eventually we saw an increase in the number of orders and in 2017 we bought the first CNC machine. The 'Make in India' initiative also helped us in generate the much-needed finance to support our business. We have been growing about 50% Y-o-Y and cater to industries like automotive, household, furniture, packaging and material handling products . We are now capable of manufacturing injection moulds upto 2000T. High precision large moulds with short delivery time makes us different from our competitors.

# Challenges faced by the Indian tool rooms...

A major portion of the Indian tool rooms consists of SMEs and it very tough for them to manage the cash flow. It is one of the prime concerns for them. It is followed by another challenge, finding the right talent or lack of skilled manpower.

# WORLD CLASS PRECISION MOULD BASES

![](_page_44_Picture_1.jpeg)

Are you looking for Precision engineering... Machining competency... Timely delivery..

![](_page_44_Picture_3.jpeg)

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# What are the growth prospects you see for the Indian tooling industry?

There are several factors favoring the Indian Tooling Industry and the biggest is the Government efforts to attract global players to manufacture in India. Another major factor is the highly volatile foreign exchange rates forcing all the manufacturers to look for domestic tool supplier for their developments. Also, the time-to-market in automotive industry has decreased significantly which means they have to develop domestic tool vendors to meet the timeline while keeping the cost low.

# A significant number of tools are still imported, why?

According to me, limited infrastructure & financial capacity of individual tool rooms in India is the major cause. Finance is available in abundance, but the rate of interest limits any new comers to take risk. At the same time, support from the OEM is not up to the mark to the suppliers for their financial needs and continuous business opportunities. In fact, payment structures are not lucrative when it comes to dealing with Indian company. Although, the Indian companies are capable and competent to meet their demands of technology & speed, finance becomes the major factor for limiting any company to get bigger lot of business at a time.

# What are the steps that can be taken to fill the talent gap?

Talking about us, we are hiring youngsters who are passionate about this industry and are talented. We Identify the talent and give them opportunity to perform individually by giving them responsibilities and needful authority.

# How can OEMs and tool makers enhance their engagement?

By collaborating. We feel that early stage involvement of tooling suppliers in the product development at OEM site will be helpful. OEMs will be able to reduce development time by combined efforts of product designer and tool designer and enhance the product quality and iteration time. Similarly, at times tool makers are not aware of the expectations and continuously work on their own way. OEMs, in such scenario, can help us chart out their expectations and help us in during the development phase.

#### Future of tooling industry...

The future of the Indian tooling Industry is very bright as 60 to 70% of tooling is still imported. There is very big scope available in latest technologies such as 2K mould, 3K mould and Carbon fiber molding, etc. As there are several new materials coming into the market for replacing many sheet metal parts, it is a huge opportunity for the industry.  $\approx$ 

# TAGMA Times recently went through a makeover. Do you find it appealing?

In our endeavor to serve you better and inform the industry about the latest happenings, new technology development, provide experts opinion and government policies, the numero uno magazine TAGMA Times has undergone some changes.

![](_page_45_Picture_13.jpeg)

We would appreciate if you share your views with us. Please give us your feedback on the below points:

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![](_page_46_Picture_0.jpeg)

### Tech Focus

# Don't Worry, It's Cool – The Power of Conformal Cooling

![](_page_47_Figure_2.jpeg)

n today's world of plastic injection, there are several factors driving long cycle times. Thermal control of the mold is the most influential aspect. With the inability to evenly cool an injected part, the cycle times run long, warpage is increased and the end product is plagued with tension and stress which often ends with parts failing quality control.

Conformal cooling technology provides the industry greater thermal control over injection molds. The increased control is accomplished through the manufacture of conformal cooled inserts custom tailored to fit each and every need. Using cooling channels in places and shapes that conform to the geometry of the part being manufactured ensures greater control over these specific, hard to reach areas. Traditional or conventional tooling simply cannot achieve the shapes, paths, and channel geometries possible with conformal cooling.

Having control of both the hot and now the cold halves you have full process parameter control. Your design solution places cooling (or heating) channels at the optimal distance from the part surface, allowing the mold to maintain a targeted, consistent temperature for complete thermal control. Conditions sometimes dictate that heating is required within the mold and conformal heating channels operate in tandem with conformal cooling channels as well. Conformal heating can assist in maintaining a molten flow front of resin as it enters a hard to fill area of the tool. This takes place much like a hot manifold operates. The heating element, in this case hightemperature oil, will run through channels that follow the shape of the part to increase surface temperature of the mold. As the resin passes through, it still maintains the melt temperature needed to properly flow and fill tight areas, such as an automotive speaker grille.

Shown here (on the left) is an example of an insert that originally contained conventional cooling channels. Beneath the image showing the circuits you can see the thermal effect the resin has on the insert in question. To the right you will see the counterpart with conformal cooling channels to address the key warm areas of the mold insert. Beneath the channel image again you can see the thermal effect on the insert. Side by side comparison shows the conformal channels provide much greater thermal control and reduced delta when used with injection molding. ~

Article & image courtesy: Milacron

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# SHOP PLAN

# The turn key solution to the Mother Industry

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As an Integrated Platform, Shop Plan effectively explores the concurrent load of the machines in the floor to take decision whether to go for In-house utility or to move outsourcing as and when required.

![](_page_48_Figure_4.jpeg)

The core module of any Project Management (PM) will be based on its capacity planning. In shop plan too, the user can do forward planning and backward planning to manage the capacity towards the end delivery.

#### ADVANTAGES

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- Notes & CAD files management
- Calendar Task Pinning

#### Macro Wire

![](_page_48_Picture_33.jpeg)

![](_page_48_Picture_34.jpeg)

# Macro Turn

# Macro Dim Treitor

Remove

![](_page_48_Picture_37.jpeg)

![](_page_48_Picture_38.jpeg)

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# Case Study

# 3D Printed Conformal Cooling Inserts Ready for Prime Time at Bastech

![](_page_49_Picture_2.jpeg)

Bastech reduces injection molding cycle times by 22%, eliminates 30-40 hours post-processing time of the molds, and 18% reduction in cost through conformally-cooled, 3d printed, metal injection molds with 3D Systems

S ince the inception of industrial injection molding, keeping an even temperature on the surface of the mold has been a constant challenge.

In their quest to maintain even temperatures, manufacturers have used baffles, bubblers and heat pipes; they've laminated blocks together and added complex drilling set ups to their molds.

Over the last decade or so, conformal cooling -designing cooling channels that naturally follow the contours of the part to be produced -- has been positioned as a solution for controlling injectionmolding temperatures. But conformal cooling adds new layers of design and production complexity to the mold-making process, placing it beyond the means of most shops.

#### "Rock-solid methodology"

Bastech, an Ohio-based one-source solution provider for shop floor, additive manufacturing services and equipment sales, has wrestled with temperature

![](_page_50_Picture_0.jpeg)

Combining 3D Systems Cimatron™ software, Direct Metal Printing on the ProX® DMP 200, and Geomagic® Control™ into a single end-toend workflow enabled Bastech to substantially reduce design time, cycle time and overall costs for injectionmolded parts

issues, but believes it has found a way to introduce a new level of simplicity, efficiency and economy to conformal cooling. The company's research is aided by its status as a 3D Systems Authorized Gold Partner, giving it access to the latest 3D printing technologies and intelligence.

Bastech's breakthrough, documented in two recent benchmark tests, is based on 3D Systems' Cimatron<sup>™</sup> mold-making software and its ProX<sup>®</sup> 200 direct metal printing (DMP) system. Simulations for the conformal cooling mold designs are performed using Moldex3D software, a partner with 3D Systems, and the completed DMP molds are inspected using 3D Systems Geomagic<sup>®</sup> Control software.

The process represents an end-to-end manufacturing solution with easy integration between the digital and physical worlds, all powered by 3D Systems products.

"The combination of powerful software designed to leverage the full capabilities of 3D printing, with printers that deliver a fully dense metal part with smooth surfaces and limited post processing provides a rock-solid methodology for building customized cooling molds," says Ben Staub, Bastech CEO.

#### Automating design and analysis

Bastech's first benchmark compared two very similar parts in terms of volume, size and design configuration. One was designed with a conformal core and then 3D printed; the other was designed with a standard spiral baffle configuration and manufactured by conventional means.

The conformal cooling design was created with Cimatron, expert CAD/CAM software that covers the entire mold-making cycle -- from quoting to design, applying engineering changes, NC and EDM programming. The latest version of Cimatron includes cooling design and analysis capabilities that support both traditionally drilled cooling channels and conformal cooling channels for manufacturing using 3D printing technologies.

Through close integration with Moldex3D, injection mold designers working in Cimatron have the ability to perform automated mold-filling analysis to optimize cooling channel layout.

"The combination of Cimatron and Moldex delivers expert software to help less-experienced engineers create better-quality designs," says Staub. "This is a major consideration as the demand for experienced

![](_page_51_Picture_0.jpeg)

8.25" X 11"

![](_page_52_Picture_0.jpeg)

![](_page_52_Picture_1.jpeg)

Expertise in producing moulds for Automotive, Engineering, Caps & Closures, Material Handling and Houseware. Capacity to produce 250 moulds per year suitable upto 2000 T Moulding Machine.

![](_page_52_Picture_4.jpeg)

Automotive, Engineering and Houseware....

![](_page_52_Picture_6.jpeg)

![](_page_52_Picture_7.jpeg)

![](_page_52_Picture_8.jpeg)

![](_page_52_Picture_9.jpeg)

![](_page_52_Picture_10.jpeg)

TTB TOOLING Plot No. 63 I Chimbali Phata Road I Village Chimbali I Chakan Taluka Khed I Pune - 412105 I Maharashtra I INDIA Contact : (+91) 98670 86216 • 83902 52520 • 88888 80179 Email : kirit@ttbtooling.com • Website : www.ttbtooling.com

#### New Dimensions To The Mould Industry....A Drive For Excellence !

# Case Study

tool-makers is much larger than the dwindling supply."

"Designing for 3D printing requires an understanding of structural support design to accomplish true requirement-based design as well as reducing material cost and build time," adds Scott Young, Bastech's Engineering Manager. "This type of expertise is built within the Cimatron software to allow our designers to think about design without having to worry about navigating through the CAD package to define complex internal channels."

#### **Big time and cycle savings**

Bastech's design for the first benchmark was a tapered helix that is positioned on the inside of a spacing cone used for industrial assemblies. Conformal cooling channels were created by rotating a teardrop configuration so that one side was parallel to the outer surface of the core while maintaining a constant distance from it. By running the cross-section along a tapered helix, Bastech was able to design geometry that the ProX 200 could build in a single run.

The design for the 3D printed mold took two days and was built on the ProX 200 in three days. To maximize its productivity, Bastech combined the 3D print run for the mold with parts required for other Bastech projects.

The ProX 200 is a cost-effective alternative to traditional manufacturing processes, offering

![](_page_53_Picture_7.jpeg)

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reduced waste, greater speeds for production, short setup times, very dense metal parts, and the ability to produce complex assemblies as a single part.

"It's a tool that enhances our capabilities on the molding side," says Staub. "It gives us higher turnaround tooling and solves bottleneck problems in the shop. We can save 30-40 hours per mold by eliminating EDM and drilling, and drastically reducing CNC and polishing work."

For the reverse-flow helix core, the design and analysis in Cimatron software, combined with 3D printing on the ProX 200, saved more than 40 hours of programming and shop time. When all costs were taken into consideration, the 3D printed core yielded a net savings of \$1,765 (18%) over conventional methods, according to Young.

More importantly, the conformal cooling mold maintained a lower temperature throughout the run and reduced cycle time by 22%.

"Cycle time is nearly everything in injection molding, with the ability to consistently control temperature a close second," says Staub.

"The more consistently we can hold temperature, the more consistently we can mold quality parts," says Young. "Eliminating warping due to temperature variation and lowering cycle time represent huge performance gains."

#### Savings beyond the core

In a second benchmark, Bastech went beyond the conformal core to design a complete core, cavity and slide-mold set for 3D printing. In this case, the goal was to maintain the same temperature (110F) between the conventional and conformal designs to see how it would affect cooling and cycle time results.

Once again, major time savings were recorded for programming, machining and polishing, and EDM

Complex conformal cooling channels created with the comprehensive mold design toolsets of Cimatron<sup>TM</sup> led to a 14% reduction in cycle time and 16% reduction in overall costs

![](_page_54_Picture_0.jpeg)

A Bastech mold core insert with conformal cooling channels prototyped using 3D Systems' Stereolithography (SLA) technology and printed in maraging steel on the ProX® DMP 200

was completely eliminated in the conformal cooling design. Automation within Cimatron software reduced design time from 30 hours to just seven for the conformal cooling mold. Total cost savings for the 3D printed mold was \$2,505, a 16% savings.

Cooling time was reduced from 10.5 seconds for the conventional mold to 7.5 seconds for the conformal mold, and the all-important cycle time was reduced by 14%.

"Even though the temperature remained the same for both the conventional and the conformal cooling designs, the conformal design forced more liquid through a greater surface area, making it more efficient in cooling the mold," says Young.

#### Major bottom-line impact

"The desire for better cooling techniques has been hanging out there for a long, long time," says Young. "We now have the software to help mold-makers make better decisions about how to set up their cavities, cores and inserts, then bring them into reality with direct metal 3D printing." "With traditional cooling for injection molding there is no perfect situation," says Staub. "You can only drill holes in certain places and you can't curve holes around channels like you can with conformal cooling designed for 3D printing. Now we no longer have to accept compromises in conformal cooling designs."

Bastech purchased the ProX 200 DMP system through a grant from the state of Ohio and the University of Dayton's Research Institute, so part of the company's mission is to share results with the industrial community. Staub hopes that Bastech's benchmark efforts will show shops of all sizes that there are solid, end-to-end solutions available to achieve conformal cooling.

"A lot of toolmakers will need to adopt these 3D technologies to improve their shops," he says. "We want to share our successes so other shops can see that not only can it be done, but it can be done in a way that has a major impact on your bottom line."  $\leq$ 

Article & image courtesy: 3D Systems, Inc.

### Product Update

#### Wire EDM machine

The ultra-modern AgieCharmilles CUT 2000 Swire EDM assembly line meets the criteria for Swiss quality. Each individually calibrated machine is delivered with a certificate of quality attesting to its conformity with the requirements of all GF Machining Solutions machines. The measurement and regulating data are stored in the machine and can be consulted or called up at any time. The machining precision is the result of a set of technical choices, such as the mechanical concept, the machining process, and wire guidance. Each element of the AgieCharmilles CUT 2000 S has been thought through and implemented in the smallest details, with the sole objective of ensuring high precision for the entire lifetime of the machine.

#### Further information:

**GF Machining Solutions Pte. Ltd. (India Branch Office)** 31/1, Seetha Rama Palaya, Off ITPL Road Mahadeveapura Road, 560 048 Bangalore, India Tel: +91 80 4079 8010 Fax: +91 80 4079 8029 Web: www.gfms.com/sg e-mail: infosingapore@georgfischer.com

![](_page_55_Picture_5.jpeg)

#### **Double Column Machining Center**

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![](_page_55_Picture_8.jpeg)

and deceleration, which improves the processing efficiency, and effectively reduces the processing time; Spindle with high rigidity bearings, with bearing diameter up to Ø70 mm and Built-in powerful spindle motor 25/29 kW, with high speed and high precision advantages.

#### Further information: Fatty Tuna India Pvt. Ltd. Global Raisoni Ind.Park Gat No.182-184, Nr.Lonikand, Phulgaon Pune-412216 (Maharashtra State) Tel: +91 7507789998 E-mail : nishantagrawal@femcoindia.com Web: www.femcoindia.com

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![](_page_56_Picture_19.jpeg)

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**BLECH** India is a highly focused exhibition exclusively dedicated to Sheet Metal Working. The event provides an ideal opportunity to present your products to this booming market and establish successful business relations, both with customers for machine tools and with potential local agents or partners for joint ventures; April 25-27, 2019; Bombay Exhibition Centre, Mumbai.

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Contact Details: Messe Frankfurt Trade Fairs India Pvt Ltd Gala Impecca, 5th Floor, Chakala, Andheri (E)

Andheri Kurla Road, Mumbai 400093, India

5-9,2019; National Exhibition and Convention Center, Shanghai.

#### Contact details:

CHINA DIE MOULD INDUSTRY ASSOCIATION (CDMIA) Tel: 86-10-88356463 Fax: 86-10-88356461 EmailL cdmia@cdmia.com.cn Web: www.dmcexpo.com

#### **InterMold Thailand 2019**

InterMold Thailand 2019 s ASEAN's largest ensemble of mold making technology suppliers to offer all solutions mold makers need to cover every facet of mold making, June 19-22, 2019; Bangkok, Thailand.

#### Contact Details:

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#### Contant details: CODISSIA GD Naidu Towers,

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#### **EMO Hannover**

EMO Hannover – the world's premier trade fair for the metalworking industry – is a key showcase for innovations and an essential driver of global production technology, September 16-21, 2019; Hannover, Germany.

#### Contact Details:

Hannover Milano Fairs India Pvt. Ltd.

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