Moldex3D
MOLDING INNOVATION

Moldex3D Industry Success Story

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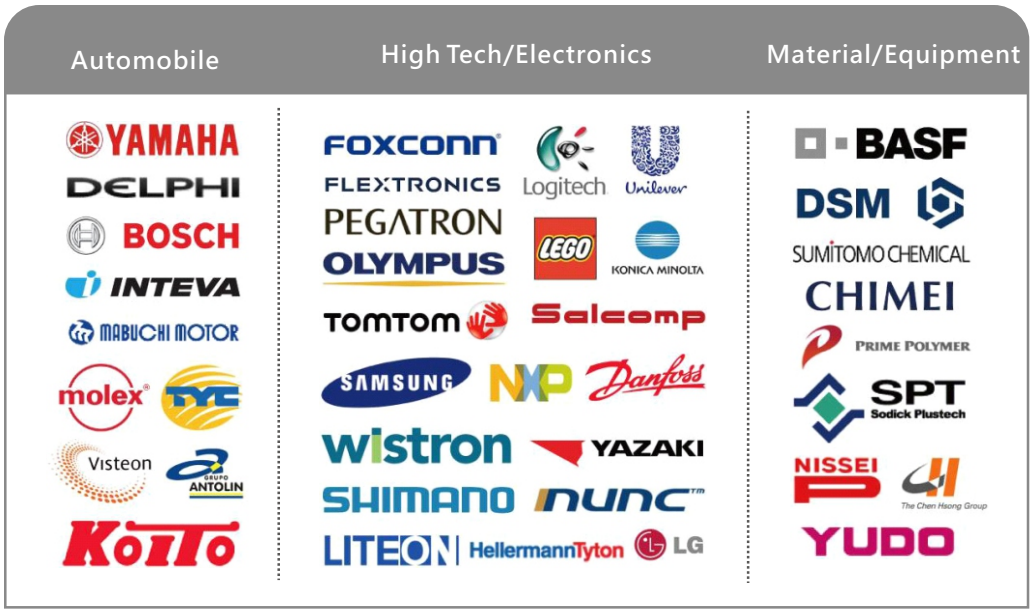
Preface

As the technology has changed rapidly, computer aided engineering software and technology are frequently used in applications for many fields for development. Among them, there are many notable improvements in plastic injection forming mold flow analysis. Since founded in 1995, CoreTech system has provided the professional CAE analysis solution "Moldex" series for the plastic injection molding industry, and the current product "Moldex3D" is marketed worldwide.

With the affirmation and support from customers of Moldex3D, we published the magazine, Moldex3D Industry Success Story. The users of Moldex3D are worldwide. In Taiwan, we have customers of ASUS, MiTAC, FOXCONN, DELTA, Foxlink, LITEON, CHIMEI, ChipMOS, MIN AIK, Panasonic, NISSAN, DSM, COXON, Tong Yang Industry, SUNUP and so on. By utilizing Moldex3D, they can point out the primary obstacles that might occur in molding, and find a counterplot before mold tooling. Moldex3D also successfully established its leading position in Japan market, many users are the patrons of us, such as DDK, Hitachi-Maxell, MITSUBISHI-ELECTRICS, MITSUBOSHI, NISSEI, OLYMPUS, ROHM, SANWA, SANYO, Sodick, SUMITOMO CHEMICAL, SUZUKI, TOYOTA, YAMAHA MOTOR, YAZAKI, etc. We also entered the South Korean market successfully; the well-known memory chip maker-Hynix and the leading consumer electronics manufacturer-SAMSUNG adopt Moldex3D series software to troubleshoot the problems from product design to development. Other users like Tokyo Seiki of Malaysia, Defond and JOHNSON ELECTRIC of Hong Kong adopt Moldex3D to solve the manufacturing problems. In European and American markets, Moldex3D is deeply trusted by many international companies, like BASF, BOSCH, DaimlerChrysler, Danfoss, DELPHI, DuPont, GRUNDFOS, LEGO, molex, NOKIA, PLASTMECCANICA, SEAT, TECH · POL, Unilever, MAGNA, Visteon and so on. The number of Moldex3D's users all over the world is countless. However, for the confidential information issues, some cases can't be published. Through the publication of Moldex3D Industry Success Story, the users worldwide can understand how to best utilize Moldex3D to improve technique and reduce cost in order to excel in the competitive market.

Nowadays, Moldex3D has become the leading provider of CAE simulation software for injection molding and extended the global sales and service network for the local users all over the world. Through the establishment of the self-brand “Moldex3D”, we have already entered international market and built global marketing service network.



Anntong Industry Co., Ltd.

Moldex3D Helps Ann Tong to Shorten Product Development Cycle and Improve Product Quality

While we are living at a time where every second counts, environmental protection has begun to raise our awareness. Hot runners thus become a "hot" subject in both injection molding industry and plastic mold industry. Hot runners can improve productivity, reduce wastes and increase the value of molds all at the same time. With the assistance of flow analysis tools, hot runners are now commonly adopted by mold industry. Here we will show you some applications of hot runners with Moldex3D software on plastic parts for 3C products, automobile accessories, and domestic appliances.

(1) 3C product - upper cover of laptop

The main concerns over laptop cover molding are the gate location and size. The gate location involves the balance of material flow and the size the effect of packing. By combining hot runner system with CAE flow analysis software, time and waste costs will be greatly reduced. This analysis not only achieves great efficiency, but also yields good-quality products (Fig. 1)

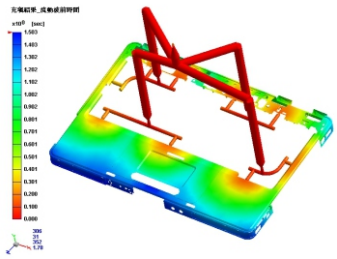


Fig.1 Upper cover of laptop

(2) 3C product - scanner cover

Plastic materials are easily compressed; therefore, improper gate location design of rectangular parts could result in changes on the product dimension. The use of hot runners with the valve gate system not only helps to accurately keep rectangular parts being injected in the same dimension with smooth appearance, but it also effectively removes welding lines (Fig. 2).

》Customer Profile

Ann Tong Industrial Co. was founded in 1989. At the beginning, Ann Tong focused on selling and importing hot runners from foreign countries like Sweden, Korean, Japan, and Germany, into Taiwan. However, there are differences between foreign and domestic demands, Ann Tong decided in 2001 to create its own brand, becoming the first company in Taiwan to manufacture hot runner systems.
(Source:http://www.hotrunner.com.tw)

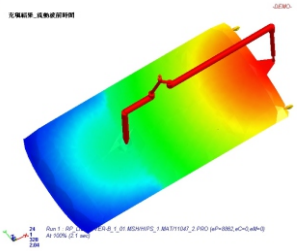


Fig.2 Scanner cover

(3) Automobile accessory - front bumper

A large plastic part usually demands a machine with heavier tons, and hot runners can effectively decrease injection and packing pressure; thus, a machine with lower clamping force can be used for production. Also, a flow unbalance problem in large size injection molding can be avoided by finding and simulating a suitable section with consequential hot runner system using Moldex3D (Fig. 3).

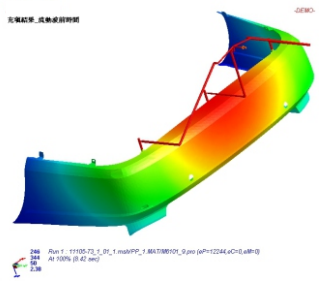


Fig.3 Front bumper

(4) Domestic appliance - double-tub washing machine body

Because a double-tub washing machine has a larger volume and greater height than a single-tub one, the thickness distribution is quite different; the location of the gate on the bottom should concern weld line position, as well as if the material flows from different gate can meet at the same time. Through CAE flow analysis, a better gate location can be efficiently found and flow balance and better end-product will then be produced (Fig. 4).

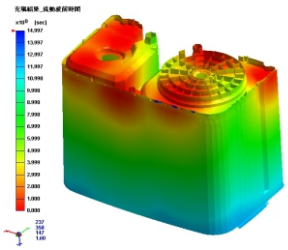


Fig.4 Double-tub washing machine body

Ann Tong's guarantees on the product

With the assistance of Moldex3D flow molding analysis software, Ann Tong's hot runner system can control mold production well to shorten product development cycle and improve product quality.

》The Solution

- Combining hot runner system with CAE flow analysis software, time and waste costs will be greatly reduced.
- Flow unbalance problem can be avoided by detecting and simulating a suitable section with consequential hot runner system using Moldex3D.
- Through CAE flow analysis, a better gate location can be efficiently found and flow be balanced, better end-product will then be produced.

》Key Benefit

The combination between Moldex3D and Ann Tong's hot runner system can control mold production well to shorten product development cycle and improve product quality.

Titan Mold Corporation

Moldex3D Significantly Saves TITAN Costs and Time on Mold Revision

Before Jason Liu's job as the managing director of his own mold making company – Titan in 1987, he had already accumulated a twelve-year experience in the mold industry. Experience shaped his reliable expertise and knowledge, and his insistence upon quality is an asset of Jason Liu that supports the company to survive in the competitive mold market. Many consumers are probably unaware of the fact that a lot of well-known 3C products appearance are made in Titan.

A decade ago, while CAE analysis software was just sprung in the Taiwanese industry, Titan already started cooperating with the CAE laboratory in National Tsing Hua University, one of Taiwanese top universities, to add molding flow analysis into the production process. Soon Titan became Moldex3D's loyal user. Jason said, when transferring the mold making line from low-cost consumer goods to expensive 3C products, how to precisely control each condition and slight change during the molding process is definitely a must-know and the key point. Moldex3D injection molding analysis software not only represents fast, accuracy, and high quality, but most importantly, customers' trust.

The multiple gating system is frequently applied on molding plastics of 3C products. It not only provides better filling and packing paths to improve quality control but also reduces cycle-time and warpage; yet, the flow trend of multiple gating system is not easy to foretell. Nowadays, Moldex3D is utilized to predict and visualize the mold-filling pattern to shorten the mold design life cycle, so that we can find the optimal gating system before mold tooling. It can also help users to find out the possible defects in advance, such as short shot, weld line, air trap and sink mark, and etc. that would significantly save costs and time in mold revision.

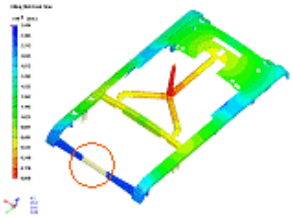
Multiple gating system—its design and application

(1) Front cover of PC case – short shot

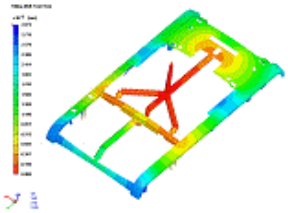
This given case shows that short shot occurs in Design 1 when only 3 gates were employed at first. Melt cannot be transferred efficiently throughout the part. After adding one more gate at a specific location and a flow leader shown in Design 2, the incomplete fill vanishes and we have a better balanced flow pattern and effective pressure delivery in packing stage.

》Customer Profile

Located in Taipei County, Titan Mold Corporation was founded in April 1989, bringing together a comprehensive range of the latest in mold making machinery and state of the art techniques. (Source: http://www.titan-mold.com)



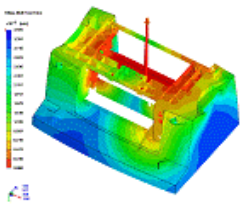
Design 1



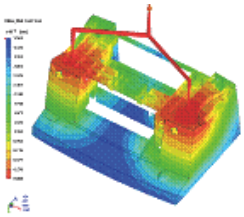
Design 2

(2) Back cover of printer – welding line

Welding line information is vital for esthetic concerns for most 3C products. Under the assistance of CAE mold filling analysis, users can predict the welding line information, including locations and the temperature. Welding line can be avoided by modifying the design of runner systems. In this product, by modifying the gate number and position (Design 2), we can adjust the filling pattern in order to reach our expectation and meet the quality standard.



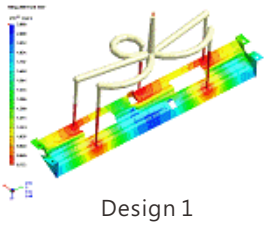
Design 1



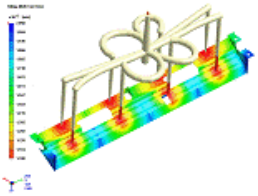
Design 2

(3) Printer chassis – unbalanced pressure

For assembly plastics, the degree of precision is crucial. By merely changing the runner length and diameters, the filling pattern of Design 2 would end up having a better balance than that of Design 1. Besides, the runner system of Design 2 provides better packing efficiency, which eliminates serious warpage problems existed in Design 1.



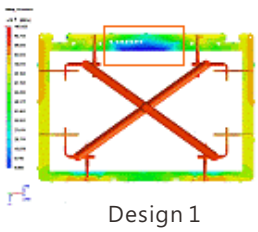
Design 1



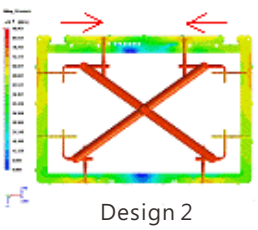
Design 2

(4) Monitor frame – unbalanced pressure

Gate positions influence the gradient of pressure drop greatly inside the cavity. In Design 1, the pressure around the marked area is higher than that of Design 2. In Design 2, we move the upper gates closer so that the pressure distribution is much balanced than Design 1, and then the required injection pressure is decreased respectively.



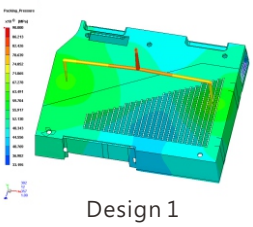
Design 1



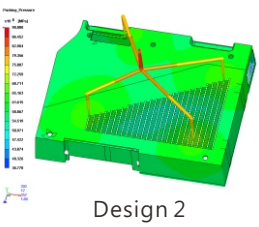
Design 2

(5)Printer cover – unbalanced pressure

In this case, we can realize that the pressure distribution of Design 2 is more balanced than Design 1; therefore, less problems on warpage.



Design 1



Design 2

》 The Challenge

Short Shot occurred in the front cover of PC case, while welding line occurred in the back cover of printer. Unbalanced pressure also occurred in printer chassis, monitor frame, and printer cover

》 The Solution

- Modify the gate design via Moldex3D to prevent short shot, and modify the design of runner systems to avoid welding line.
- Reach balanced pressure by changing the runner length and diameters

》 Key Benefits

Moldex3D helps users find the optimal gating system before mold tooling and the possible defects in advance, which would significantly save costs and time in mold revision.

Rooted in Taiwan, Titan and CoreTech System (Moldex3D) both take on international perspectives

Titan now has offices and factories both in Taiwan and mainland China, and customers ranging from PHILIPS, Acer, BenQ, CalComp, Quanta, etc. Moldex3D has helped Titan completing hundred of mold cases, including the most popular precise electronics: digital camera, laptop, cellular phone, scanner chassis and multifunction machine. CoreTech System and its professional CAE plastics injection molding analysis software – Moldex3D are the best business partner of Jason. He showed a positive attitude when mentioning Moldex3D's efforts and support to local mold industry. Although a long way have Titan and CoreTech System(Moldex3D) come through, they still keep walking ahead.

Grand Dynasty Industrial Co., Ltd

Moldex3D Helps Grand Dynasty to Reduce Time to Market

Low labor cost in mainland China has put the plastics industry in jeopardy. Dr. Lawrence Lin, the President of Grand Dynasty, receiving his PhD of polymer plastics engineering in the University of Massachusetts, was aware of the importance of simulation software to the molding industry when he was still in the US. After back to Taiwan, the success stories about Moldex3D made him notice this first true 3D simulation and analysis CAE software for injection molding, and soon Grand Dynasty began a cooperative relationship with CoreTech system. "Moldex3D has a very complete technical support system, and its simulation analysis results are precise. Moreover, Moldex3D is easy to learn and to use, engineers without a CAD background become familiar with the software really fast." Dr. Lin praised.

Product life management (PLM) is progressively emphasized nowadays, and design and prototyping schedule are tightened correspondingly. Moldex3D is a good solution for mold designers. For runner system design, Moldex3D can be used in catching flow balance and optimizing gate number and its location. For the cavity function, Moldex3D is capable of predicting the filling pattern such as welding line, air trap and short shot...etc., and more, providing advices on part revision. For the cooling system, users can evaluate the preferred cooling layout and avoid unacceptable heat accumulation in the mold by using Moldex3D.

Benefits of utilizing Moldex3D

A remote controller's upper cover (Fig. 1) has the problems of flow balance and welding line. By the efficiency of Moldex3D in modeling and calculation, runner system revision and filling result can be evaluated in minutes (Fig. 2).

Fig.1 Actual sample

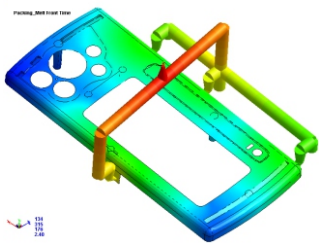


Fig.2 Moldex3D filling analysis

》Customer Profile

Grand Dynasty Industrial Co., Ltd. has been the worldwide provider of services from plastic injection molding, mold production to product design behind several well-known automotive and IT manufacturers. The main products of Grand Dynasty are high-priced precision parts, including automobile parts, halogen lamp base, and athletic equipment. Most of these parts are made of certain high-performance plastic materials, such as PEI, PPS, and PEEK. (Source: http://www.grand888.com/)

A remote controller's bottom cover (Fig. 3) needs to be assembled with the prior one. Via Moldex3D's Warp module, the calculated deformation of both parts can be exported as STL or mesh models into the most popular CAD systems and we can take this topic into account in advance (Fig. 4).

Fig.3 Actual sample

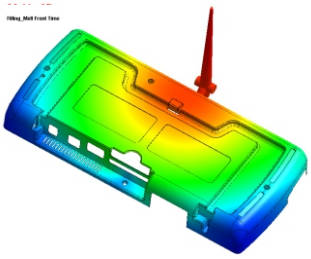


Fig.4 Moldex3D Warp

A chassis (Fig. 5) has serious heat accumulation in core platen. By utilizing Moldex3D's Cool module, a preferred cooling system is concluded before mold tooling, which effectively decreases the cycle time and mold revisions (Fig. 6).

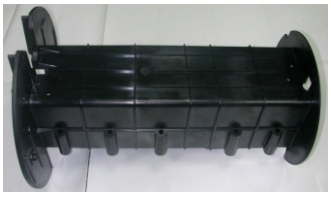


Fig.5 Actual sample

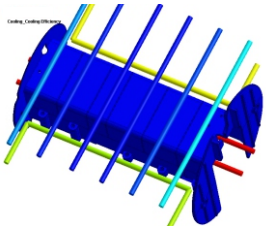


Fig.6 Moldex3D Cool

A LCD monitor (Fig. 7) base cover might have hesitation and air trap problems. The hesitation and air trap might occur in grilled regions correspondingly. Under the efficient assistance of Moldex3D's Flow module, these possible defects can be avoided and cleared up (Fig. 8).

Fig.7 Actual sample

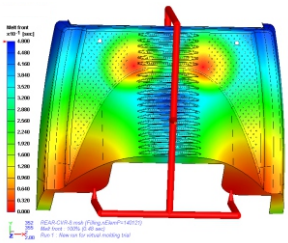


Fig.8 Moldex3D Flow

Grand Dynasty Industrial's cooperative relationship with CoreTech System(Moldex3D)

For Grand Dynasty Industrial, the advantages of adopting Moldex3D are that it can detect problems instantly and propose solutions, therefore reduces the chances of errors. Consequently, more clients are putting their trust in the company. "One of our clients was only asking for the price, but in addition to that information; we also gave him a complete analysis report using Moldex3D. We received the order the next day." Dr. Lin said in content.

Even now Taiwan's plastic industry has to face the critical competition against the low-cost production from mainland China. Why can Grand Dynasty still maintain an enviable business growth? The combination of Grand Dynasty and Moldex3D did it; we made the possibilities come true.

》The Challenge

Product life management is progressively emphasized nowadays, and design and prototyping schedule are tightened correspondingly.

》The Solution

For runner system design, Moldex3D can catch flow balance and optimize gate number and its location. For the cavity function, Moldex3D can predict the filling pattern such as welding line, air trap and short shot. For the cooling system, users can evaluate the preferred cooling layout and avoid unacceptable heat accumulation in the mold.

》Key Benefits

Moldex3D helps detect problems instantly and propose solutions; therefore, reduces the chances of errors.

SAMSUNG Electronics Co., Ltd.

SAMSUNG Electronics Introduced Moldex3D As The Standard CAE Tool for Injection Molding

There is no doubt that SAMSUNG Electronics is maintaining its market leadership in the global market (DRAM, SRAM, TFT-LCD, Color monitor, CPT & CDT, VCR, flash memory, Microwave, CDMA Handset, and so on), and SAMSUNG had sold 86.6 millions of its mobile phones in 2004, accounted for 12.7 percent share of the global market. Visual Display Group is one of top profit making departments. SAMSUNG Electronics maintains the top position in global market share of Color TVs, monitors. As one of few electronics companies with profound competencies in both A/V and IT, SAMSUNG has the foresight and willingness to make industry-leading investments in the future.

VPD (Virtual Product Development) is a popular topic nowadays. However, to achieve this goal not only requires professional developers, but suitable CAE software to benefit the collaborations. What we commonly understand are to evaluate the mechanical reliability, thermal management, electro-magnetic compatibility, and etc; but producibility should be considered as the key, since simulation tools for fabrication help to predict what will possibly occur during the production stage, which could save lots of possible expenses on trouble-shooting and the yield improvement.

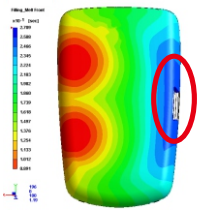
Moldex3D can predict the short shot region

Mobile phone is always the focus in consuming electronics industries. In order to win consumer's heart, all components need to be designed as fancy and exclusive among numerous new models. However, this demand is usually not easy to reach because the new design would be much more complex than traditional ones and more challenging in the current molding technology. In this study, the short shot region is almost identical to the molded part, which goes on to prove the accuracy of Moldex3D. It guarantees the simulation result is valuable especially for exploring a revolutionary design.

》Customer Profile

Founded in 1938, SAMSUNG has maintained a mission statement that responds both to its own change, and to new developments in the world: "Economic contribution to the nation," "Priority to human resources," "Pursuit of rationalism." Each slogan represents significant moments in SAMSUNG's history, reflecting different stages of the company's growth from a domestic industrial leader into a global consumer electronics powerhouse. (Source:http://www.samsung.com)

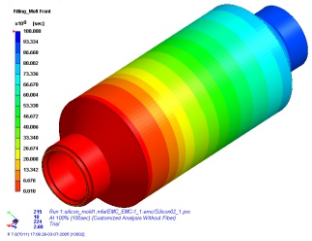
Actual Sample

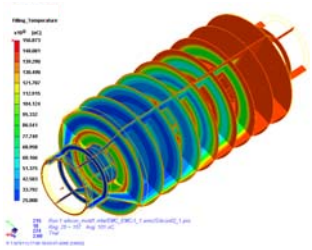


Melt front

Cable encapsulation

Reactive Injection Molding (RIM) is widely applied to provide an encapsulation that tolerates higher working temperature, and provides high reliability in thermal, mechanical and electrical property. However, the resin is thermosets, of which chemorhelogy is more complex than thermoplastics. Through Moldex3D, the design parameters and process conditions can be verified, instead of physical prototyping and tedious trial-and-error.





Moldex3D scrutinizes each development stage for Samsung, ensuring the production quality.

Through the introduction of the practical studies above, these cases demonstrate that Moldex3D possesses talented integrity for various purposes, widely from product conceptualization to prototyping stage. Moldex3D should definitely be in the list if you want to expand the VPD simulation tools to reach the optimum in such competitive business environment.

》The Challenge

Adapt to the ever-changing and more challenging product design requirements.

》The Solution

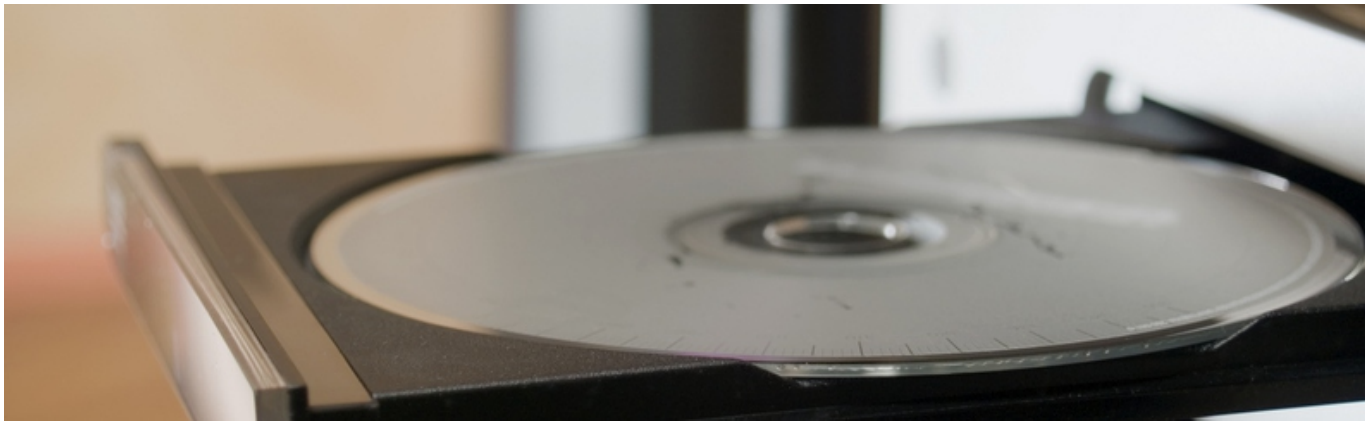
Reactive Injection Molding (RIM) is widely applied to provide an encapsulation that tolerates higher working temperature, and provides high reliability in thermal, mechanical and electrical property.

》Key Benefits

Through Moldex3D, the design parameters and process conditions can be verified, eliminating physical prototyping and tedious trial-and-error.

Tokyo Seiki Co., Ltd.

Tokyo Seiki Reduces at Least 50% of its Time in Trial-and-Error Using Moldex3D



With the help of Moldex3D, Tokyo Seiki becomes the first mold maker in Malaysia to provide CAE analysis reports with vivid pictures and graphics. As a result, more and more potential customers are surfacing to Tokyo Seiki because they feel more confident about this kind of service and analysis. Previous engineering manager of Tokyo Seiki, VC Chong, pointed out: "Nowadays, the intuitional and traditional-experience-relying mold design have proven difficult to satisfy the ever-changing demands. Our biggest advantages and secret weapon is to use the scientific and precise CAE calculation to determine the quality of the mold design and even to persuade customers to modify their original design." Now at least 50% of the molds Tokyo Seiki produces are mainly modified by Tokyo Seiki itself, such as the runner imbalance problems in the printer parts, and the warpage enhancement of the camera parts for a famous brand.

CAE analysis was only part of VC Chong's work; he used Moldex3D to help him manage the project execution time more efficiently. "On average, I have to spend 2-3 days each week in analysis to ensure the production of some inexperienced designs, so I let my computer run CAE cases at nights and test the results in the morning." He added "Comparing the Moldex3D Solid analysis time with the real mold trial time, the former is definitely worthy of our investment, because we have saved at least 50% of the time in revisions and trial frequency."

The injection molding analysis contains many different projects we can discuss in different point of view and according to various demands. For a mold manufacturer, the manufacturing time is very short, so explicit analysis is the key factor that helps customers eliminate problems quickly and efficiently. Mr. VC Chong used this concept on designing and producing, so the Moldex3D can be utilized powerfully. Here we will introduce the real case studies provided by Tokyo Seiki in order to discuss two key points – flow balance and welding line in injection molding simulation.

》The Challenge

- Inner part of a DVD-Rom Flow balance problem.
- Motorcycle horn buttons welding line problem.

》The Solution

After revising the runner for five times, the flow balance had increased from 88% of the original design to 99% of the 5th revised design, and the runner weight to part body ratio became 10g :16g.

》Key Benefits

Ensure company's competitiveness and the commitment to delivering the best quality design to customers.

Flow Balance Problem

To balance flow pattern is a good way to prevent warpage problems, especially for the precise products, the flow balance is what we usually take as the comparative data. The case discussed here is the inner part of a DVD-Rom that can be produced up to 60,000 pieces per month. Besides flatness, the customers also ask Tokyo Seiki to cut down the runner weight, because the runner weight is apparently higher than the part body (20g : 16g). After revising the runner for five times, the flow balance had increased from 88% of the original design to 99% of the 5th revised design, and the runner weight to part body ratio became 10g :16g. (Fig. 1~4)

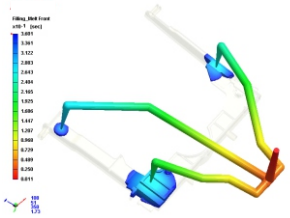


Fig.1 Melt front distribution at 60% of original design

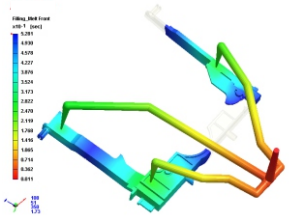


Fig.2 Melt front distribution at 88% of original design

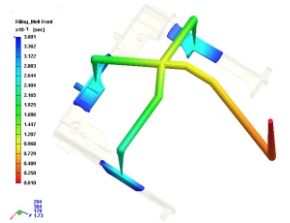


Fig.3 Melt front distribution at 60% of original design

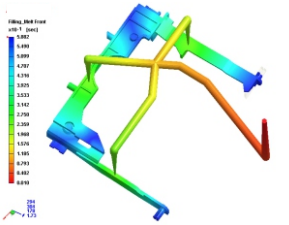


Fig.4 Melt front distribution at 99% of original design

Welding Line Problem

The position and length of welding lines are usually the first to consider in the simulation field when products are suspected to have aesthetic or mechanical strength problems. In this case, we would discuss the motorcycle horn buttons, which are pressed many times after fabricating; therefore, the welding line is "the" factor that influences the part strength. We should avoid putting a welding line on the strength-receiving region during molding production. In this simulation process, we notice that the welding line is on the place where forces are received, which could weaken the product's strength. We can solve this problem by changing the gate location. (Fig. 5~8)

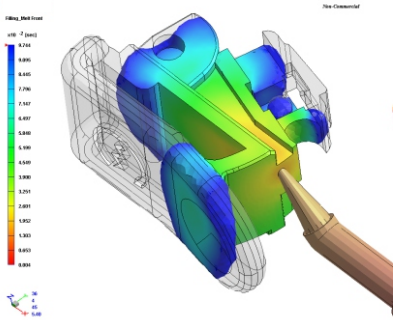


Fig.5 Melt front distribution at 60% of original design

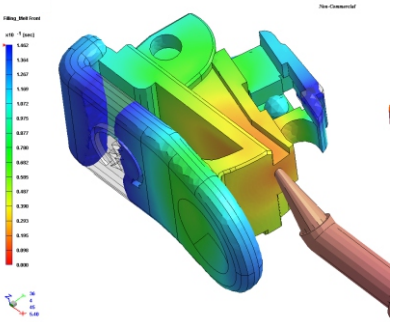


Fig.6 Melt front distribution at 90% of original design

"Nowadays, the intuitional and traditional-experience-relying mold design have proven difficult to satisfy the ever-changing demands. Our biggest advantages and secret weapon is to use the scientific and precise CAE calculation to determine the quality of the mold design and even to persuade customers to modify their original design." said VC Chong, Previous Engineering Manager, Tokyo Seiki.

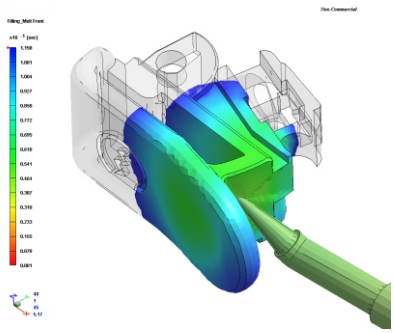


Fig.7 Melt front distribution at 60% of revised design

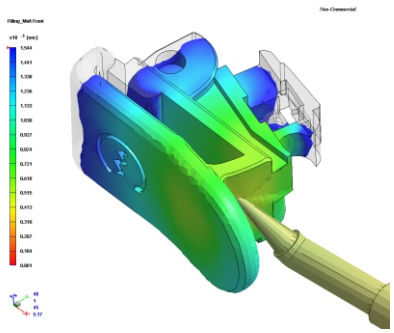


Fig.8 Melt front distribution at 60% of revised design

Tokyo Seiki Continues to Invest on Moldex3D

For Tokyo Seiki, a new mold development could be completed within three weeks, but the mold trial time and retooling was unpredictable. After Moldex3D was adopted, they were able to limit the mold trials to no more than 3 times. To strengthen Tokyo Seiki's ability to produce other kinds of mold products, VC Chong's company is ready to increase investment on Moldex3D this year. VC Chong perceives adopting Moldex3D as the best decision to increase company's competitiveness and to provide the good-quality design to the customers.

YULON-NISSAN Motor Co., Ltd.

Yulon NISSAN Uses Moldex3D to Improve Automotive Parts' Strength

Source : www.nissan.com.tw/

In early 2005, YULON Nissan and Moldex3D worked together again on an important LSUV (luxury sport utility vehicles) development and testing. The top LSUV is to pinpoint the top class consumers; therefore, the perfect quality is necessary in each manufacturing cycle. The washable luggage board is a special case here, for it requires good structure strength, since a poor one will usually cause deformations.

During the development stage of a product, the mechanical strength is an important issue even above product appearance and functions. But especially for the injection molding product, mold property is another influential factor. When changing the product layout and thickness distribution, the strength and the properties of mold change accordingly. Therefore, it is insufficient if one only considers one of these factors mentioned above.

Digging out the defects in molding using injection molding simulation and assess various functional aspects of product utilizing other CAE software, by doing so one can be assured that the product quality is depending on a good design.


Fig.1 Luggage board 1


Fig.2 Luggage board 2

Problems on washable luggage board design. This case is the luggage board inside a vehicle, which has to satisfy the following points: the board is required to be strong enough to load passengers or cargoes, the board weight must be light enough to facilitate getting the spare tire under, and the board has to be flat from an esthetic point of view (Fig. 1~2). The luggage board combines metal and plastic in the previous design. The metal part can overcome the problem of warpage and strength but will take too much time and cost during production. Besides, the heavy weight also increases the oil expense.

》Customer Profile

YULON Nissan was founded on October 22, 2003 in Taiwan. Since then, YULON has been receiving awards for its excellent performance and services. For example, ISO 9001 and ISO 14001 certification in November, 2004. YULON Nissan believes in cooperating car and people into people's daily life. (Source: http://www.nissan.com.tw/)

》The Challenge

Problems on washable luggage board design. The board is required to be strong enough to load passengers or cargoes therefore, the board weight must be light enough to facilitate getting the spare tire under, and the board has to be flat from an esthetic point of view.

》The Solution

Proved to precisely predict the unbalanced thickness that affects the deformation and able to control the structure strength under the safety and satisfaction.

Moldex3D helps strengthening the board

In the revised design, we change to a better layout and thickness distribution. Only a single plastic material is applied but the product remains the same mechanical strength and flatness. This can simplify manufacturing process, reduce costs and the product weight. By the assistance of Moldex3D, we can find the optimum product design in injection molding, and then assess the strength by structural analysis (Fig. 3~6).

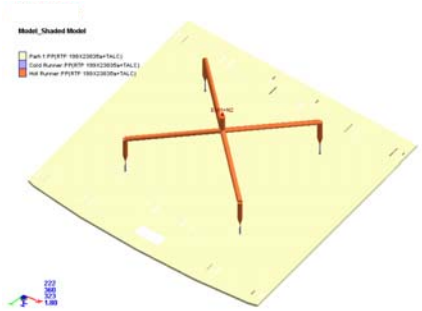


Fig.3 Runner layout

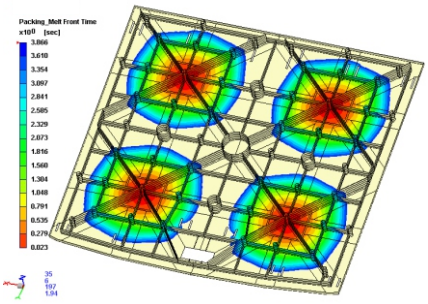


Fig.4 Melt front 50%

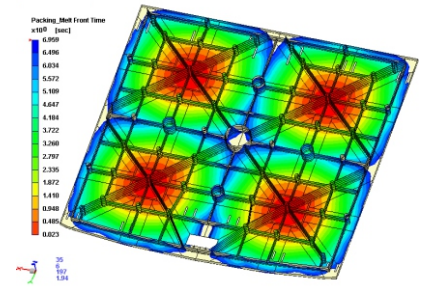


Fig.5 Melt front 90%

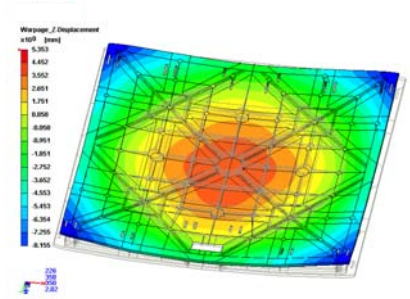


Fig.6 Warpage/Z-displacement

Moldex3D's success with automobile industry

On the washable luggage board case, Moldex3D participated in the early design cycle and played an important role to provide suggestions and guide the direction. Moldex3D is proved to precisely predict the unbalanced thickness that affects the deformation and able to control the structure strength under the safety and satisfaction. YULON engineer, Mr. Lin Hua-Long, is one of the key cooperation persons: "Moldex3D is very user-friendly. The Icon list is very clear and well-organized, which makes the software easy to operate. Most importantly, the results are good enough to reduce our cycle time and save costs," he approved.

" Moldex3D is very user-friendly. The icon list is very clear and well-organized, which makes the software easy to operate. Most importantly, the results are good enough to reduce our cycle time and save costs. "

》Key Benefits

Change to a better layout and thickness distribution. Only a single plastic material is applied but the product remains the same mechanical strength and flatness. Simplify manufacturing process and reduce costs and the product weight.

Beaumont Technologies, Inc. (BTI)

BTI and Moldex3D Provide the Most Advanced Solutions for Runner Design

Over one decade of involvement in plastics industry as his career and study, David A. Hoffman has made the plastics processing much easier, more creative, and more innovative. So far he has worked as the Global Director of Technical Sales & Marketing in Beaumont Technologies, Inc (BTI), the leading provider of mold and process optimization technologies. CoreTech and BTI have established a reliable relationship based on technical cooperation.

David holds an Associate Degree in Mechanical Engineering Technology and a Baccalaureate Degree in Plastics Engineering Technology from Penn State University. He is the author of various published ANTEC papers. He also worked as the Engineering Manager for an automotive supplier of high precision plastic components and assemblies for years. Later he started working for BTI until now. While at Beaumont Technologies, he has co-invented the company's second patent along with John Beaumont on a next generation MeltFlipper® MAX™ Technology, known as MeltFlipper® MAX™, which is capable of re-establishing multi-axis material property symmetry within the melt channels and cavities of cold and hot runner molds. CoreTech and BTI aim at introducing their techniques to local users who desire CAE simulation analysis or runner design optimization for better productions. In any single part of multi-cavities mold, there is still a problem of an intra-cavity imbalance that possibly results in part inconsistencies from cavity to cavity even though flow to each cavity is balanced. Now, a new-patented melt-management technology- MeltFlipper® MAX™ presented by BTI can provide symmetry of high sheared laminates in multiple axes.

》Customer Profile

Beaumont Technologies, Inc. (BTI) was founded in 1998 and is headquartered in Erie, PA. BTI is the industry leader in the development and application of rheological control systems. Though BTI provides a unique mix of products designed to optimize the efficiencies of the mold and the injection molding process, its focus is on the optimization of the melt delivery system and its impact on the molding process and resultant molded part quality. (Source:http://www.beaumontinc.com)

Flaws existed in the original runner design

We can see any single parts in multi-cavity mold may still experience an intra-cavity imbalance, which may cause part inconsistencies from cavity to cavity, even though flow to each cavity is balanced. There are two basic options to solve this problem. The first option is to add one additional melt rotation to control the position of the high sheared material within the part in order to force those laminates to flow through the center of each cavity. The second option is a new-patented melt-management technology – MeltFlipper® MAX™ that provides symmetry of high sheared laminates in multiple axes. This technology provides for more homogeneous melt

condition to enter into a cavity. In injection molding application, this latest innovation may help prevent core shift, and increase flow lengths for thin walled applications, and provide the ability to manipulate and manage the melt flow front within a part (Fig.1).

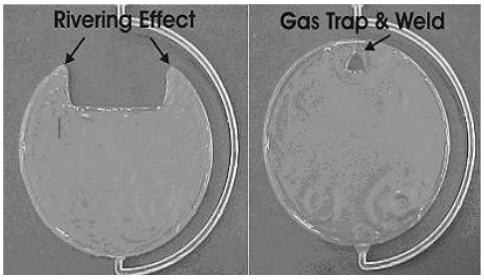


Fig.1(a) Rivering flow front due to intra-cavity imbalance in a single cavity mold

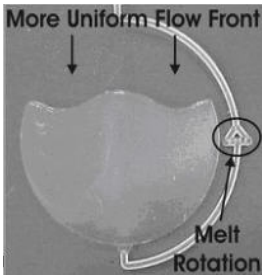


Fig.1(b) Modified and controlled flow front using melt-management technologies

Melt-management technologies as discussed here may be used to address both cavity-to-cavity or intra-cavity imbalances within any given mold, either low cavitation or high cavitation, hot runner or cold runner. Through Moldex3D CAE tool, we can easily visualize the imbalanced phenomenon and verify the availability of MeltFlipper® MAX™. Figure 2 and 3 have illustrated the examples of a single cavity mold and each of them is an A-type single mold. With a single cavity mold, there cannot be any cavity-to-cavity imbalances since there is only one cavity. But the non-desirable flow front in the single cavity is the problem in these cases, which is solely due to the shear imbalance creating non-uniform material properties within the cavity. In A-type mold, it usually results in a weaker welding line at center of sample.

》The Challenge

In any single part of multi-cavities mold, there is still a problem of an intra-cavity imbalance that possibly results in part inconsistencies from cavity to cavity even though the flow to each cavity is balanced.

》The Solution

Through Moldex3D CAE tool, we can easily visualize the imbalanced phenomenon and verify the availability of MeltFlipper® MAX™.

》Key Benefits

The combination of Moldex3D and MeltFlipper® MAX™ not only can detect the cause of intra-cavity imbalance flow but also can solve the filling imbalance problem easily and properly.

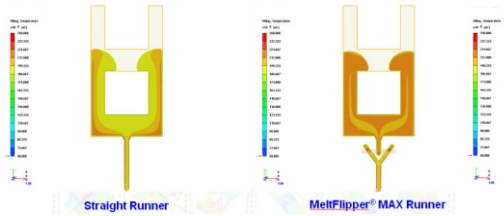


Fig.2 Temperature distribution of 70% filling melt front in an A-type mold. (L)original runner design (R) with MeltFlipper® MAX™ runner design

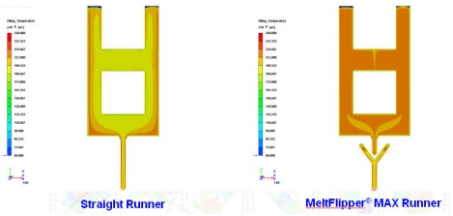


Fig.3 Temperature distribution of filling end melt front in an A-type mold. (L) original runner design (R) with MeltFlipper® MAX™ runner design

By understanding shear and flow of plastics, a designer can now begin to apply melt-management technologies in the initial mold design stage based on certain part geometry and number of cavities. Melt-management technologies also help eliminate the manual inspection and sorting costs required from customer rejects or day-to-day molding scrap, thus allowing companies to replace their inspectors and put producers in their place (Fig. 4).

Fig.4(a) Weld line formed by cold melt which results in brittle fracture

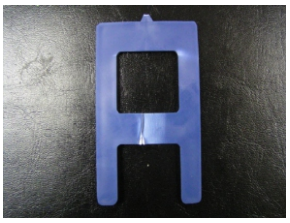


Fig.4(b) Weld line formed by hot melt which results in ductile fracture

Double win

Moldex3D can help people know how the intra-cavity imbalance flow happened, and MeltFlipper® MAX™ can solve the filling imbalance problem easily and properly. CoreTech and BTI have established a reliable relationship based on the technical cooperation. We have been the exclusive reseller of MeltFlipper in Great China and Taiwan. For more information about MeltFlipper® MAX™ technology, please contact CoreTech or BTI directly.

Chi Lin Technology Co., Ltd.

Moldex3D Successfully Lowered Chi Lin Technology's Manufacturing Costs

In recent years, Chi Lin has expanded its business into precise injection molding industry. It helps Chi Mei to produce a broad range of plastic products, including key components for TFT-LCD market. To meet various TFT-LCD products requirement, the geometries of plastic products can be very complicated. In addition, the question of production cost and efficiency makes the development and mold part design even more difficult. Nowadays, light, slim, and large sizes are the basic requirements for developing TFT-LCD products. For those manufactures, it is always a big challenge to meet these standards. In 2002, Chi Lin adopted Moldex3D simulation analysis technique to measure the feasibility of a product design plan in the early stage of product design process.

Moldex3D can detect flaws in original designs

The sample product in discussion here is TFT-LCD plastic substrate. The flatness required should be controlled in less than 1.5 mm, and the problems of flash and dust are not allowed. There are two problems for the design: higher injection pressure can result in higher stress that further induces warpage problems, and flash occurs due to the lack of enough clamping force.

(1) Hesitation phenomenon

To better understand this product development, filling behavior is examined by short shot investigation numerically and experimentally. (Fig. 1, 3) show the simulation results and (Fig. 2, 4) are experimental results of original design. Obviously, both numerical prediction and experimental verification are in a good agreement. Results also show that hesitation happens in the center portion of the part. These figures also point out the melt front distribution and the location of weld line. In addition, from the advancement of melt front(Fig. 5), the filling in the cavities can be observed all the time and the location of weld line and air trap can be predicted. Meanwhile, the short shot phenomenon can be estimated and this helps users to identify where the vents should be located.

》Customer Profile

Chi Lin Technology was founded in 1964, and is one of many subsidiary companies of the Chi-Mei Group (see *). Product mix originally started from PE Film related products and was then expanded to include Plastic Color Compounding and Composite materials. Chi Lin has been playing an important role in the "plastic processed material" field in Taiwan for more than 40 years. (Source: http://www.chilintech.com.tw)

》The Challenge

To meet stringent thickness requirements; no flash or dust are allowed.

》The Solution

Revised design with increased thickness in those two thin areas has been proposed to resolve the problems of original design.

- Hesitation phenomenon has been solved
- Sprue pressure and clamping force are reduced
- Stress is reduced
- Warpage has been improved

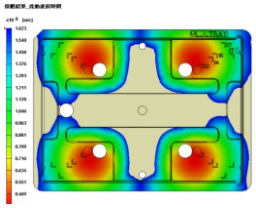


Fig.1 Melt front prediction of original design

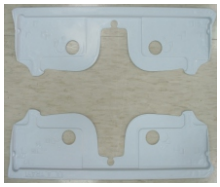


Fig.2 Real short shot sample of original design

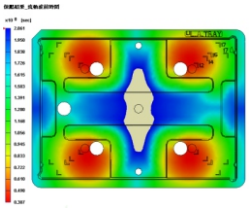


Fig.3 Melt front prediction of original design

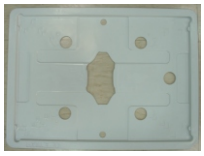


Fig.4 Real short shot sample of original design

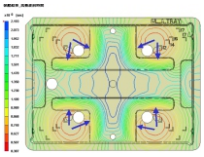


Fig.5 Melt front iso-contour of original design

(2) Clamping force is too high

The history curves of sprue pressure and clamping force (Fig. 6, Fig. 7). The sprue pressure is up to 114MPA (1 MPa=9.8kg/cm2) and the clamping force reaches to 1200 ton. Indeed, these history curves can be used to monitor the pressure behavior and the required clamping force during the filling/packing phases. Then the pressure in the runner and gates can be determined. Hence, the estimated pressure can provide users the reference of runner and molding design.

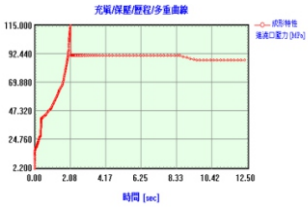


Fig.6 The history curve of sprue pressure

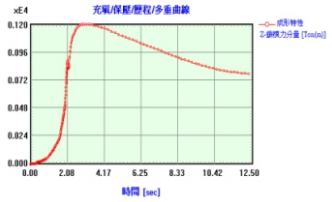


Fig.7 The history curve of clamping force

(3) Stress is too high

Shear stress distribution of the original design (Fig. 8). Clearly, it has demonstrated that high stress (>1Mpa) is the key factor of product warpage. In general, it should not be higher than 0.5 MPa (1MPa=9.8kg/cm2)

(4) Warpage problem is serious

The warpage displacement distribution ranged between –1.46~1.56 mm in Z-axis (Fig. 9). This result shows that the warpage is very serious and it doesn't meet the criteria.

Targeting the problems, end product improved significantly

The main problem of original design is there are two thin areas in the part. Therefore, this revised design with increased thickness in those two areas has been proposed to resolve the problems of original design.

(1) Hesitation phenomenon has been solved

Those figures of melt front and real mold trial (as shown from Fig. 10~14) clearly indicate the hesitation phenomenon has been solved.

"Ever since 2002, Chi Lin has successfully used Moldex3D software to develop more than hundreds of products, and the results have shown that Moldex3D helps not merely reduce the research development cost but also improve the RD time management and product quality." said Lee Mao-Song, President of Chi Lin Technology Co., Ltd.

》Key Benefits

The results have shown that Moldex3D not only reduces the research development costs but also leads better time management and product quality.

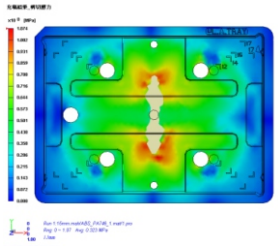


Fig.8 Shear stress distribution

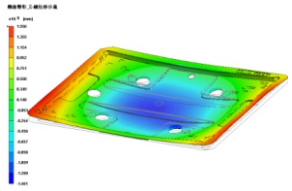


Fig.9 Warpage prediction in the thickness (Z-axis) direction

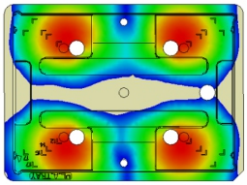


Fig.10 Melt front prediction of revised design

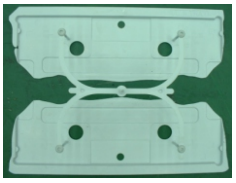


Fig.11 Real short shot sample of revised design

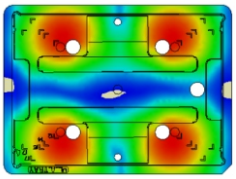


Fig.12 Melt front prediction of revised design

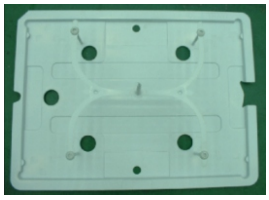


Fig.13 Real short shot sample of revised design

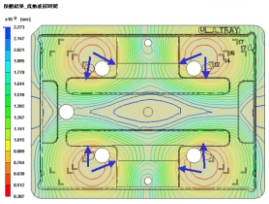


Fig.14 Melt fron iso-contour of revised design

(2) Sprue pressure and clamping force are reduced

As illustrated, the stress goes down to 89MPA (1 MPa=9.8kg/cm2) and the clamping force required is decreased to 920 ton (Fig. 15, Fig. 16).

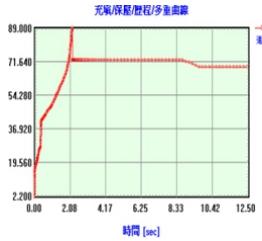


Fig.15 Revised design: history curve of sprue pressure

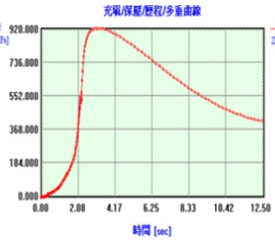


Fig.16 Revised design: history curve of clamping force

(3) Stress is reduced

The shear stress distribution for the revised design (Fig. 17). The shear stress is smaller than 0.5 MPa in this whole area. Clearly, the high shear stress portion in the original design is removed.

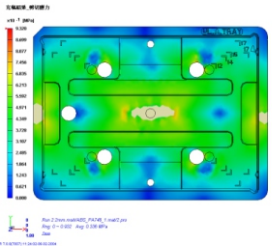


Fig.17 Shear stress distribution of revised design

(4) Warpage problem is improved

Finally, the warpage distribution in thickness direction (Fig. 18). The warpage amount is controlled between –0.52 and 0.56 mm. Obviously, the warpage problem is greatly improved.

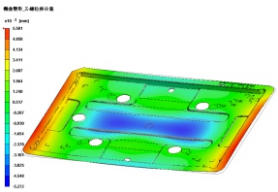
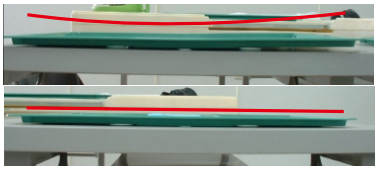


Fig.18 Warpage distribution in thickness (Z-axis) direction

Save time and money

By using Moldex3D to perform numerical simulation for the injection product design and development, Chi Lin can catch the crucial problems at the right time. Thus the production cost is dropped and the competence is increased. The president of Chi Lin Technology Co., Mr. Lee, said, "From the past few years, the competition in the TFT-LCD monitor market was becoming extremely fierce. Knowing how to reduce the product manufacturing costs and increase the speed and efficiency in the production line is certainly an important issue for every manufacture. Therefore, the implementation of Moldex3D simulation analysis technology will meet these criteria. Ever since 2002, Chi Lin has successfully used Moldex3D software to develop more than hundreds of products, and the results have shown that Moldex3D helps not merely reduce the research development cost but also improve the RD time management and product quality."



Original design (upper) and revised design (bottom)

MiTAC International Corporation

Moldex3D Facilitates MiTAC's Designing Process

MiTAC Precision Technology Corporation (MPT)'s primary business includes tooling and mass production, ranging from design, mock-up, tooling to plastic injection, stamping to coating, as well as printing and post-production assembly services.

Through professional injection molding simulation software Moldex3D, now engineers of MiTAC are able to quickly check the manufacturability of the injected plastic part design. This time-saving, highly accurate and user-friendly function of Moldex3D mold filling simulation enables the R&D team to facilitate efficient discussion and commutation on the confirmation and optimization of the product and mold design. Thus, Moldex3D unquestionably plays an extremely important role in "Quality control of mold design" and "Communication platform of the design."

As a result, Moldex3D has been well-appreciated by its customers for its remarkable achievement in 3S (Software, Service, Solution). In 2006 and 2007, Moldex3D was awarded by two of the leading technology companies: ASUS Computer Inc. and MiTAC Precision Technology Corp., in their 2006 and 2007 annual event with the prestigious honor of "excellent supplier of the year" and "The best software supplier of the year".

Evaluate runner and gate design using Moldex3D

The design of runner and gate is one of key factors which significantly have impacts on product quality, especially for gate location selection and runner layout. Therefore, engineers of MiTAC usually adopt Moldex3D analysis to evaluate the design of runner and gate.

1. Observe the simulation of melt front, and users can understand the injection behavior of the melted plastic material from nozzle to cavity. As the melt front analyses show, users can acquire the pressure required for runner and gating and evaluate pressure drop condition to determine adequacy of runner layout and gate type (Fig. 1~3).

2. Observe whether the melted plastic material is evenly filled in the cavity.

3. Observe uniform and even filling in the cavity and prevent short shot or excessive filling.

》Customer Profile

MiTAC Inc., founded in 1974, is the first member in the Group family and the largest IT system integration provider in Taiwan. With extensive backgrounds in all aspects of hardware, software, communication, networking, integrated testing, training, maintenance and consulting services, MiTAC is dedicated to helping industries and the government to achieve targets in productivity and quality with a total solution. (Source:http://www.mitac.com.tw)

4. As the warpage analyses shown in Fig. 4~6, users can observe whether the pressure evenly transmit to each plastic part, and accurately perform packing to manufacture the product with condense filling and a clear-cut shape.

5. In the system of multi-cavities, proper runner and gate location shall achieve balanced filling so that the plastic material may be filled in each cavity at the same to ensure the consistency of the finished product of each cavity.

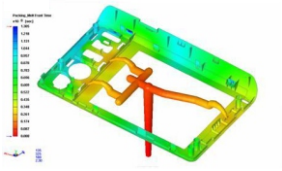


Fig.1 The melt front simulation of cover component of 3C products

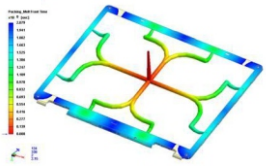


Fig.2 The melt front of the frame component of 3C products

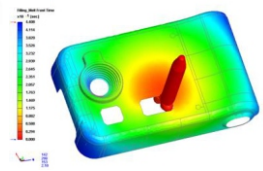


Fig.3 The melt front simulation of cover component of 3C products

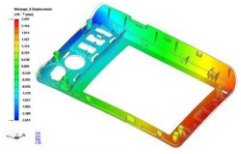


Fig.4 The warpage analysis of the framework of 3C products

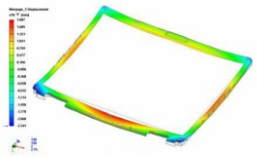


Fig.5 The warpage analysis of the frame of 3C products

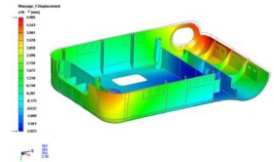


Fig.6 The warpage analysis of the cover component of 3C products

Design thickness layout

The design of thickness layout is another important factor on product quality. Proper design will prevent problems of flow hesitation and short shot, and further improve the part quality.

1. Observe the simulation of melt front, and users can understand the influence of various thickness conditions in the flow process. Fig. 7 shows the flow analysis of multi-gate product.

2. Investigate heat dissipation phenomenon in different thickness zones with the display of temperature and evaluate whether thin-wall may cause the flow hesitation and short shot. Fig. 8 shows the analysis result of temperature. If the gates are located at the central area of thin thickness, it might cause the problem of short shot due to the temperature undergoes a rapid drop.

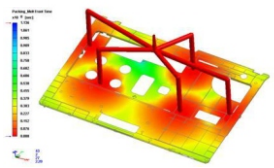


Fig.7 The flow simulation of cover part of laptop

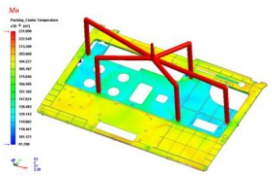


Fig.8 The temperature distribution of cover part of laptop

》The Challenge

The designs of runners, gates and thickness layout are crucial to product quality.

》The Solution

Leverage on Moldex3D analysis to evaluate the gate location and optimize runner and thickness layout.

》Key Benefits

Enhance product quality and significantly reduce trial-and-error iterations. Optimize cross-department coordination and the integration of various development procedures

Moldex3D-Mesh: mesh creating made easy

Besides, to meet the specific needs for a wide array of injection simulations, Moldex3D is proud to provide the multi-functional pre-process mesh known as "Moldex3D-Mesh". The advanced functions of Moldex3D-Mesh allow the users to create/export/fix/edit mesh models effectively, determine the runner layout and cooling system and prepare different meshes required for various types of analysis in advance. As the complicated model shown in Fig. 9, Moldex3D-Mesh allows the users to mesh the model efficiently and quickly.

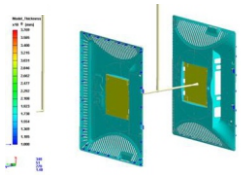


Fig.9 The big size cover part of 3C products

MiTac's Appreciation

Moldex3D can be used for enhancing the quality of design and significantly reducing the times of mold testing while optimizing cross-department coordination and the integration of various development procedures. Finally, Moldex3D would like to thank AsusTek Computer Inc. and MiTac Precision Technology Corp. for their support and appreciation.

SimpaTec Simulation & Technology Consulting GmbH

Successful 3D Simulation of Decorative Parts

In January 2007, a customer from the automotive industry contracted Schuster Kunststofftechnik GmbH to develop and produce a panel module for an air-conditioning system by IML. To allow it to meet the required price and high quality specifications, the process parameters, in particular the cycle time, gating system and the special requirements for processing décor films in the mold, must be specially matched to one another. For this, the IML specialist commissioned SimpaTec Simulation & Technology Consulting GmbH, a consulting engineer specializing in process and part optimization in the plastics industry, to model the entire injection molding process in a simulation.

Simulating the process from filling to warpage

From its own practical knowledge, Schuster realized that it would be necessary to precisely model the mechanical and thermal properties of the PC film in the simulation. Consequently, SimpaTec ran through the process using Moldex3D, the software from Taiwan for injection molding simulation, which has a successful track record over many years in German automotive industry. It is capable of simulating the entire process from filling to warpage.

Although Moldex3D also permits 2.5D simulation, SimpaTec practically only performs complete 3-D simulations in practice. That allows very reliable warpage analyses to be performed. The quality of the program is shown particularly in the high-quality mesh capabilities. Besides tetrahedrons, hexahedrons, prismatic and pyramidal elements can also be used. The mold, too, enters three-dimensionally into the simulation. This is particularly important for new developments in mold technology, such as conformal cooling.

The first task is to replace the conventional cold-runner manifold originally planned with a hot-runner system with small cold-runner sub-manifold. The simulation is solved by placing the hot-runner nozzles as close as possible to the cavity such that only a cold-runner such-manifold of 1.05g in total remains. Compared to the original cold-runner weight of 13.50g, this reduces the material consumption by 12.45g per shot; this is equivalent to a cost saving of around EUR 60,000 over a production time of six years. The precise gate geometry and flow aids are determined by the software.

》Customer Profile

SimpaTec Simulation & Technology Consulting GmbH, offer the plastics processing industry products and services in two business areas: in the process and component part optimization through simulation and, and in technology transfer in the People's Republic of China. In both business areas they can make use of many years of experience of the management and executive staff members. (Source:http://www.simpatec.com)

That allows the mold to be completely filled with a pressure reduced by 130 bar. That has a beneficial effect on the retaining of structure within the film at cores around which the melt flows. At the calculated ends of the flow path, particular attention is paid to venting.

What is the influence of warpage?

A special challenge in the design of IML articles is the part warpage. The simulations for determining the resulting warpage show a surprising result: the warpage is largely independent of the gating system and process parameters. The geometry of the part and the asymmetric structure resulting from the film echnology generates significant warpage. The part becomes convex towards the visible side.

This behavior, in which the part folds slightly in the center, occurs because of the high volumetric shrinkage in the thick-walled regions of the domes, and because the stiffness of the base plate is reduced by cut-out sections. This phenomenon can only be compensated by making geometrical changes, not by relocating the gating point.

In a detailed discussion among the project managers, the causes of warpage are analyzed and the improvement suggestions worked out. All aspects of the process are completely simulated Moldex3D. The 3D simulation of the film thus makes the effects of isolation clearly visible. This property is indispensable for reliable simulation of the IML process. Ultimately, it is the temperature distribution in the boundary layer between the film and part that dominates the warpage. The thermal conditions in the mold can also be three-dimensionally reproduced by the software for efficiently tailoring the cooling system to the IML process. Based on these results, Schuster Kunststoffechnik implemented a more effective cooling circuit for the interior regions of the part-after mold production. such a change is extremely expensive, since it can usually only be realized by partial rebuilding of mold with relocation of the slides and ejectors.

Since the warpage depends on a large extension on the part geometry, the company informed the customer. The search for alternatives proved difficult, since the geometric conditions cannot be fundamentally changed because of the planned light reflection properties, and the design of the operating unit. The customer decided on a compromised solution: all the functional dimensions affected by warpage are investigated according to their tolerance with respect to adjacent parts. As the result of analysis, openings and centerings could be redesigned before the start of mold manufacture.

After completion of the mold, the process parameters of the simulation are first imported. This step considerably simplifies the sampling process. The simulated operating points are confirmed in practice to a good approximation, as is shown by the filling pressure comparison.

》 The Challenge

Develop and produce a panel module for an air-conditioning system which meets the cost requirements and high quality specifications.

》 The Solution

Replace the conventional cold-runner manifold originally planned with a hot-runner system with small cold-runner sub-manifold.

》 Key Benefits

Reduces the material consumption by 12.45g per shot; this is equivalent to a cost saving of around EUR 60,000 over a production time of six years.

The simulated warpage agrees well, both qualitatively and quantitatively, with reality. The customer, who was initially surprised by the extent of the predicted warpage, is now relieved that this fact could be taken into account during mold design. This also includes the optimization of the snap connection to the housings, as a result of which warpage is now minimized during installation. In this manner, the project could be completed well within schedule.

Summary

The project flow confirms that 3D simulation can identify the main problem areas in the manufacturing process. The realistic simulation of the films used in the IML process is new - it allows critical questions about process-oriented mold design to be answered. Without this aid, the warpage is particularly difficult for processors to predict. This allows the severe challenges of the automotive industry - quality and costs, freedom of design, attractive appearance and faithfulness to schedules. The applications demonstrated the versatility of complete 3D injection molding simulation, and its potential for future part development, including for special injection molding processes.

Power Tech Mold Co., Ltd.

Power Tech Uses Moldex3D to Solve Air Trap and Weld Line Problems

Quality improvement and production cost reduction have become a crucial issue for customers in various industries. As a result, it becomes necessary for industries, while doing production planning, to have a solid mechanism of mold filling analysis before design and production stages. In the plastic industry, Moldex3D provides Power Tech a valuable guidance to break free from traditional methods and perspectives of manufacturing processing and planning. In this article, using Armrest's cup holder as an example, after the cup holder is put through a carefully analysis by CAE several times, we can detect the difference that the change of each parameter makes. These differences enable the designer to review and prevent errors before production. This will allow the user to enhance competitiveness through significant reduction of cost and time. This case study involves an Armrest with the situation stated above (Fig. 1). There is a huge difference existing between cup holder area and main thickness of the cup (Fig. 2). When the melt fills the mold it creates a visible air-trap phenomenon. Under the circumstance that the alteration of product shape is not allowed, aside from changing the thickness of the item, a simple solution does not seem to exist. Foregoing analysis and attempting a trial and error method to fix the problem would result in a prolonged process and incur much unnecessary expenses.

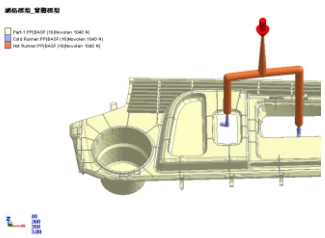


Fig.1 Armrest Model Geometry

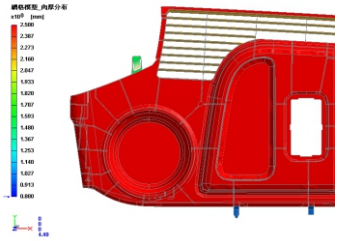


Fig.2 Original Thickness Distribution

The best course of action for Power Tech at this point would be to put it through a CAE analysis to discover the optimum gate position to balance the melt flow and further change the thickness to prevent the air-trap appearing in the first trial.

》Customer Profile

Founded in 1994, Power Tech Mold Co., Ltd. main focus has been the manufacturing of plastics injection molding products. The purchase of a single and three multi-component injection molding machines and transformation into ODM (Original Design Manufacturer) has helped Power Tech cater to customers by designing, manufacturing, and producing a series of products. Power Tech has also established its mold and injection departments. By June 2007, the quality assurance department was established to monitor the whole manufacturing processes. This effectively enhances the quality of end projects and ensures clients' right and satisfaction. (Source: Power Tech Mold Co., Ltd.)

Actual sample correspond with Moldex3D predictions

Figure 3~5 show the progress of the melt flow. These figures show the upper part of the plastic flow is faster than the lower part. The problem is that when the upper part of the mold is filled, the lower part is barely completed thus the air-trap and the weld line problems occur. As the melt flows through the mold towards A, it fills B towards the lower recesses of the cup frame. The figures below show the progress at 83% and 91% completion. In terms of flow conditions, the flow speed on the bottom is relatively slow compared to the speed of the upper part of the cup; therefore, changing the thickness would be the key factor to avoid air-trap under the premise that the end product appearance would be changed as well. In this article, we chose thickening the bottom of the cup to let the plastic flow faster as the simulating scenario.

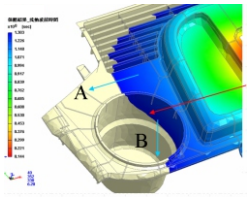


Fig.3 Melt front prediction at 83% filling stage

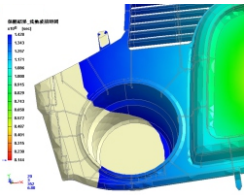


Fig.4 Melt front prediction at 91% filling stage

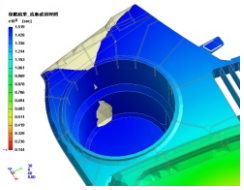
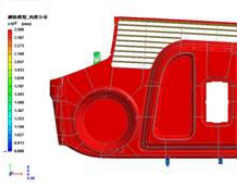


Fig.5 Melt front prediction at 96.8% filling stage

Figure 6 demonstrates the changing of thickness. The red region in Fig. 6 illustrates the mold with a thickness of 3mm. Some region's thickness has been reduced to a thickness of 2.5mm to solve the problem of air-trap.

Fig.6(a)



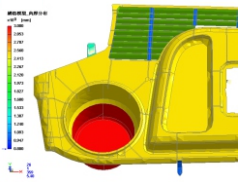


Fig.6 (b)

They yellow region's thickness is reduced from 3mm to 2.5mm

Below figures show the simulation results are quite similar to actual short shot samples (Fig. 7~14). Moreover, the analysis results show that a weld-line occurs at the location of original air-trap because of the thickness change, which is the same as the actual short shot sample.

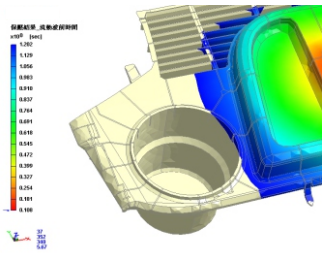


Fig.7 Melt front prediction at 75% filling stage

Fig.8 Actual short shot sample

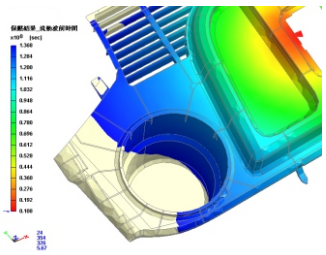


Fig.9 Melt front prediction at 90% filling stage

Fig.10 Actual short shot sample

》The Challenge

In this Armrest's cup holder case, there is a huge difference existing between cup holder area and the main thickness of the cup. When the melt fills the mold, it creates a visible air-trap phenomenon.

》The Solution

Leverage on CAE analysis to find out the optimum gate position to balance the melt flow and further optimize the thickness to prevent air trap problem.

》Key Benefits

Engineers are able to successfully eliminate molding defects by utilizing preventive measures based on CAE analysis results.

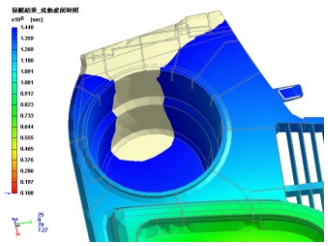


Fig.11 Melt front prediction at 92% filling stage

Fig.12 Actual short shot sample

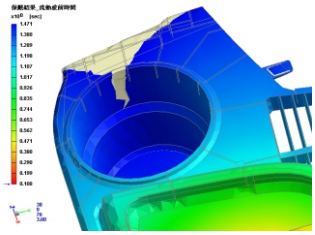


Fig.13 Melt front prediction at 96% filling stage

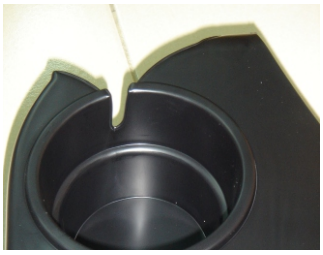


Fig.14 Actual short shot sample

Better accuracy, more trusts

Based on above analysis, when an end-product needs to change the flow condition or solve key problems, very often a company will adopt the method of thinning the major thickness. As the example in this article shows, although the air-trap problem may be solved due to the changing of major thickness, another problem to the end product might occur because the thickness of the cup remains the same. Therefore, under the premise that the appearance is to be unchanged, another way to change the direction and speed of the flow would be thickening some portions of the thickness. Before the test shot from design, mold producing to analysis, this time, some preventive measures have been planned out based on CAE analysis results so that engineers are able to successfully minimize the molding problems.

G plast(Pvt) Ltd

Synergy of True & Full 3D Simulation and Conformal Cooling

With more and more challenging marketing and customer demands, technologies, which can ensure the better quality, cost performance, time to market and so on, are always what we would absolutely look for. This is the same for the injection molding industry - As we know, the cooling time often occupies 70% of the injection cycle and critical for most of the warpage issues. When process optimization and quality improvement is a priority, we always try to find some lights in this cooling stage.

The customer of this successful case study, Gplast, is from Coimbatore, India. With more than three decades of experience and expertise in tool and die making, injection molding and die casting, Gplast is very well known for its achievements in electronics, precision machine tools and transport.

Warpage is the first priority since product quality is affected a lot. However, due to the geometric limitation, revising process conditions or other efforts could not really lead to satisfying enhancements. Since conformal cooling is one of the key advantages of Gplast, it is decided to use the true and full 3D Computer Assisted Engineering (CAE) tool to evaluate the effectiveness of the customized cooling layout designs.

》Key Benefits

- Warpage Improvement.
- Cycle time reduction: about 400,000 seconds are saved annually and productivity enhancement.
- Long-term unsolved quality deviation is fully resolved.
- Recycling of cooling fixture is eliminated and profitability is enhanced.

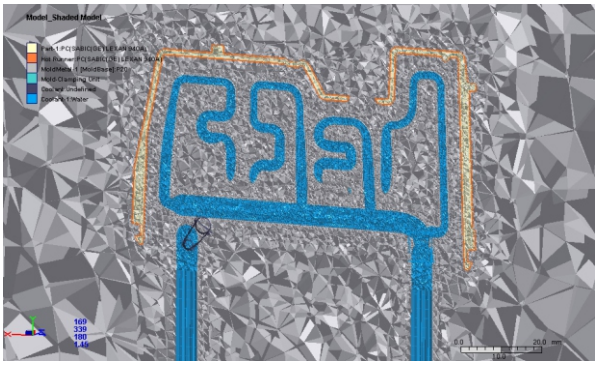


Fig. 1. Cooling channels and mold base – true 3D mesh model for simulation accuracy

One of the important concerns in this case is – the traditional 1D runner or cooling layout is not capable for simulating correct results due to theoretical and functional limitations.

After using Moldex3D Solid for complete simulation of the original cooling layout design, the analysis result shows the internal temperature is quite high and there is a region with heat accumulation. The mold temperature difference results in the non-uniform shrinkage – finally it leads to the warpage problem which is related with thermal effect.

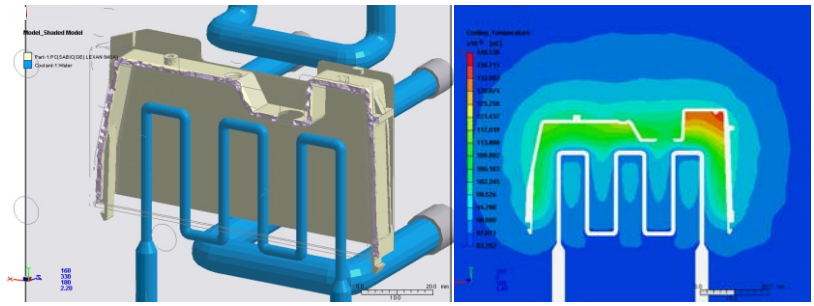


Fig. 2. Original cooling layout (left) and the mold temperature difference (right)

To improve this warpage problem, conformal cooling design is applied for solutions. Moldex3D is again used for performing reliable analysis via complete and high-performance 3D simulations. After revising the cooling system, the mold temperature difference is greatly reduced from 40°C to 6°C – about a 85% improvement. In addition, the temperature of the corner region (with exceeding heat in original design) is much more uniform.

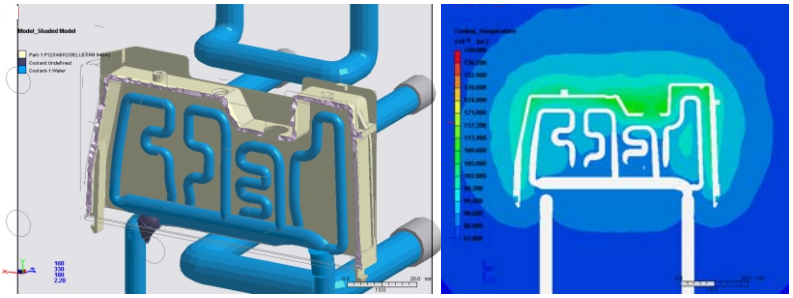


Fig. 3. Revised cooling layout (left) and the mold temperature difference (right)

Compared with the original design, the Z-displacement of the revised cooling system is reduced 25.6%. The target of the cooling system optimization is successfully reached by such an outstanding warpage improvement. In this case, Moldex3D simulation results are highly consistent with the real injected parts.

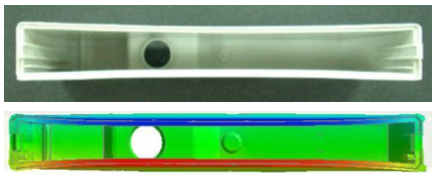


Fig. 4. Warpage of original design – real injected part and simulation result

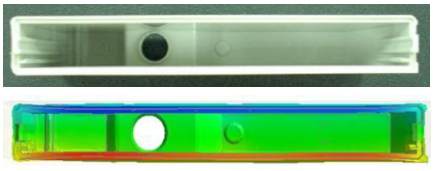


Fig. 5. Warpage results of revised design with conformal cooling – real injected part and simulation result

" One of the fundamental reasons for choosing Moldex3D in spite of being a customer to other CAE tools in the market was that we were looking for a professionally true and full 3D customized solution in terms of analysis and who can be a strong partner working with us in providing the best solutions. After these successful cases, we feel that Moldex3D is truly supporting for conformal cooling, and the effectiveness is satisfying. In addition, the technical support and service quality of EUC Tech and CoreTech teams is very impressive and far beyond our expectations! We are glad that we made the right decision." said Mr. G.D. Rajkumar, the Director of Gplast.

Behind the Scene

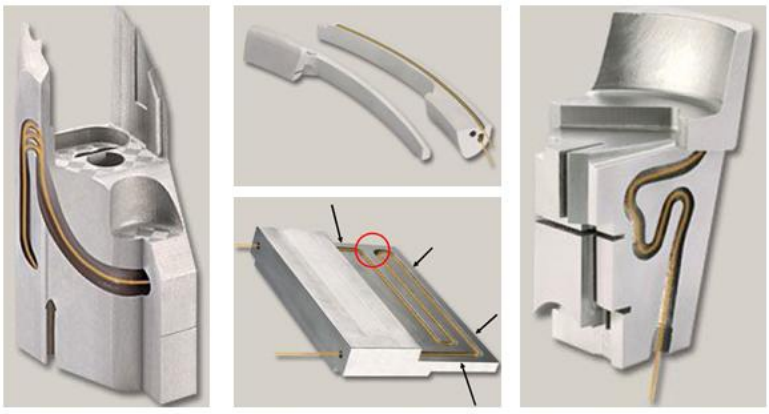
This is just one of many successful cases done in Gplast. The synergy of true 3D simulation and conformal cooling design capability proves not only the quality issues like warpage can be effectively eliminated, but also the product development cycle time would be improved. The true 3D Simulation plays an important role to identify the connections between revised cooling designs and the results. Without these analysis results, it would be difficult to precisely evaluate the contribution of different conformal cooling layouts. The application of Moldex3D brings the real confidence for both product development and the performance of conformal cooling designs.

In short, the real performances of this case include:

- 》Warpage Improvement
- 》Cycle time reduction (Annual: about 400,000 seconds are saved) and productivity enhancement
- 》Long-term unsolved quality deviation is fully resolved.
- 》Recycling of cooling fixture is eliminated and profitability is enhanced.

About Conformal Cooling

Conformal cooling is defined as the ability to create cooling / heating configurations within a tool that essentially follows the contour of the tool surface or deviates from that contour as thin / thick sections of the part may dictate for optimal thermal management. The objective typically is to cool or heat the part uniformly. Conformal cooling provides a tremendous advantage in mold tooling through significant reductions in cycle times. Besides the obvious piece - cost savings, other tangible benefits include



Plastik HT

Plastik HT, Czech tool Manufacturer, Successfully Leverages Moldex3D to Minimize Product Deformation

This article describes one of the problems PLASTIK HT had and was successfully solved by the aid of Moldex3D. A subcontractor made a tool and during the first trial of part sampling a problem with warpage appeared. The part was unacceptable warped in the area as visible in the picture (Fig. 1)

Fig.1 The warped part after first sampling

So there was a simulation based on the real parameters of the tool (the whole tool was made from steel) and process conditions (Fig. 2)

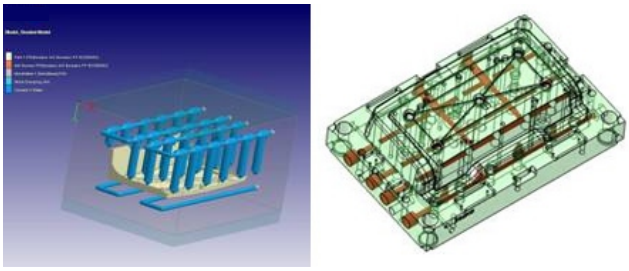


Fig.2 The tool layout and the core side of the tool

The warpage results corresponded with the real part as visible in the pictures (Fig.3a, 3b)

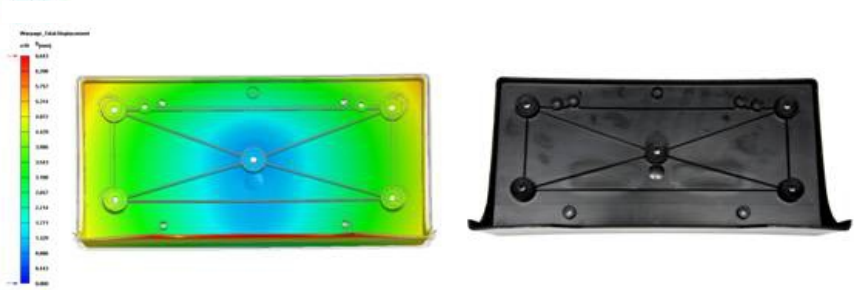


Fig.3a Warpage results from Moldex3D

Fig.3b Real part warpage

》Customer Profile

PLASTIK HT a.s. is privately owned Czech company with more than 45 years of tradition specializing in the production of technical plastic injection mouldings for the automobile and electronic industries, utilizing only the latest production technologies. Each production program is built by using four independent foundations, all bound into one tailored solution. PLASTIK HT strives to become a renowned, world – class producer of advanced plastic products and assemblies and to achieve a leading position in the production of such parts in Europe, with an impact on global markets.
(Source:http://www.pehtoo.com/)

During the results analysis, the possible reason of the unacceptable warpage was found. The cooling in the critical area was not sufficient enough and the temperature difference on the tool surface was up to 50°C (Fig.4a,4b). That difference together with quite high temperature on the part (Fig.5) may have an effect on the final warpage of the part.

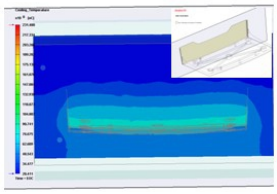


Fig.4a Temperature difference in the mould

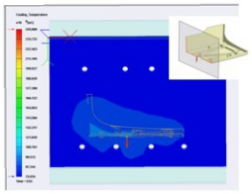


Fig.4b Temperature difference in the mould

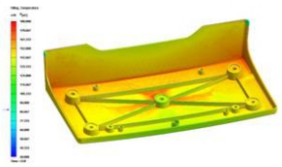


Fig.5 Temperature on the part

Based on the simulation results, the tool was modified by adding an insert of a bronze to improve the cooling in the problematic area to reach the faster cooling down of the part (Fig.6).

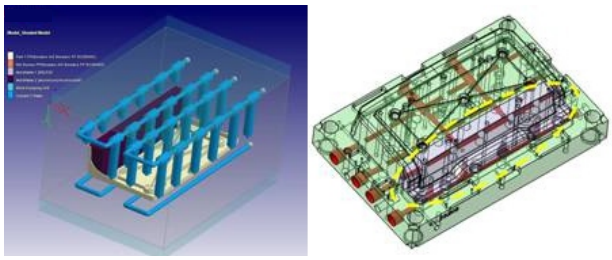


Fig.6 The modified tool layout and the core side of the tool with the bronze insert

The aluminum insert improved the cooling in the critical area significantly. The results showed the temperature difference was reduced to less than 15°C on the tool surface (Fig.7a,7b) and the temperature range on the part become more uniform(Fig.8).

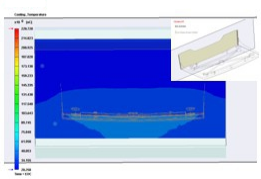


Fig.7a Temperature difference with the bronze insert

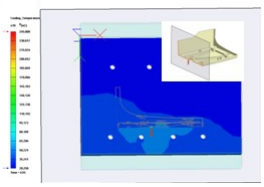


Fig.7b Temperature difference with the bronze insert

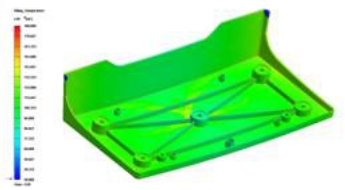


Fig.8 Temperature on the part from the mould with the bronze insert

The improving modification of cooling system mentioned above solved the problem of warpage. The final part deflection was reduced and its direction was changed to an acceptable range.

In the pictures below (Fig.9, 10) you can see the predicted warpage by Moldex3D and as clearly visible the results match with the deflection of the real part quite precisely.

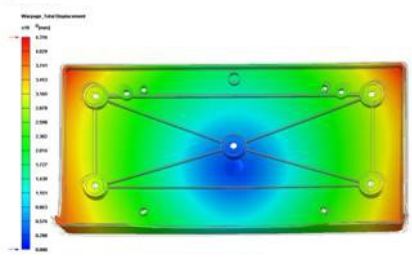


Fig.9 Moldex3D warpage prediction

Fig.10 Real part deflection

Moldex3D has been used in our company since January 2007. During that time the software proved itself to be a reliable tool for the simulation analysis to predict the cooling, filling, packing and warpage problems that may appear in a production.

》 The Challenge

During the first trial of part sampling a problem with warpage appeared

》 The Solution

Insert molding improved the cooling in the critical area significantly

》 Key Benefits

Final part deflection was reduced and its direction was changed to an acceptable range.

Ramcar Technology Inc.

Automotive Battery Leader Ramcar Turned Complexity to Competitive Advantage

Using simulation to verify design quality and speed up the time to market is no longer an impossible mission since CAE (computer aided engineering) solutions are much more popular and user-friendly nowadays. However, eliminating the gap between design concepts and manufacturability is still difficult due to various concerns like the limitation of prototype testing, insufficient understandings of production parameters, etc. For plastic part and mold design teams, it might be an even more challenging task to ensure the manufacturability because polymer is comparatively complicated – quality issues would happen with the combinations of parameters or different conditions.

For decades, Ramcar Technology Incorporated (RTI), the leading battery manufacturer specializes in designing and building a wide range of plastic injection molds, and the team has an average of 15-20 years experience in this industry. Foreseeing that more and more challenging demands are pursued by customers: like lead time, quality, cost, etc., RTI decided to implement CAE analysis tool for plastic injection molding to secure leadership. After 2 years, Simulation-driven design and manufacturing helped RTI reach two major successes they expected:

- 》 The mold developing cycle is greatly shortened by about 70% - optimized product development process can be figured out at the shortest time possible.
- 》 The verified design know-hows and know-whys became RTI's technical asset and competence.

The below RTI case witnesses one of the most wonderful concepts from Peter F. Drucker, the Father of Modern Management – "Efficiency is doing things right; Effectiveness is doing the right things."

It is an upper cover of an automotive battery with deformation problem. Some people might feel this part looks simple. But it is really complicated if we deeply look into the entire development cycle – we would be surprised with how much time and cost consuming it would be if we go with the traditional trial-and-error way.

》 The Challenge

Prototype testing limitation, insufficient understandings of production parameters and other quality issues.

》 The Solution

Implemented Moldex3D CAE analysis tool and leveraging on its quick design verification capabilities to improve product quality.

》 Key Benefits

Mold developing cycle is greatly shortened by about 70%.

Generally speaking, deformation means headache. Many advices might come from different teams: part design, tool design, material, molding, etc.. However, if effectiveness is the goal, what are the right priorities we should pick?

From past experiences, RTI knows clearly that modifying the thickness design would be the right thing to reach customer's expectation. However, RTI also knows the way they selected –revising the part design is the most difficult one. At least the answers for the three questions below need to be well prepared:

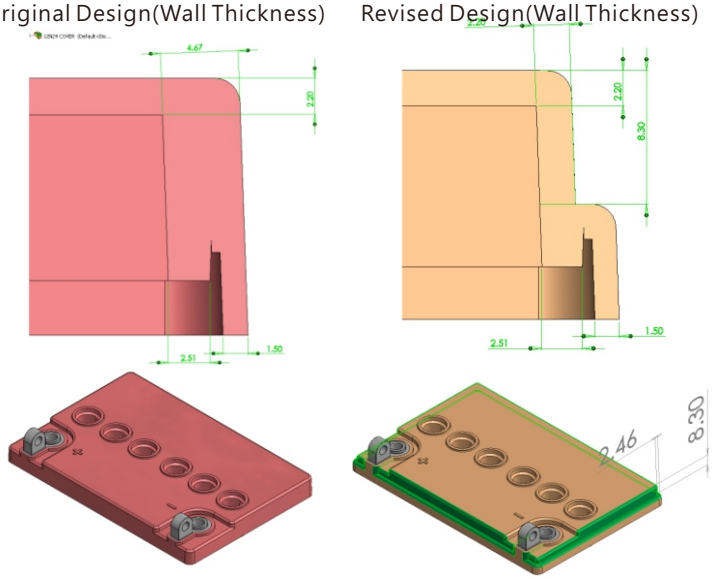
》How to convince the customer this is the right thing to do?

》Where and how to modify?

》What is the interaction of different design parameters and how to handle it?

" Customer's specification is 0.5mm for concave warp while 2.0mm for convex warp. The actual warp is 2.3mm concave warp. We suggested to revise the wall thickness to make it uniform but the customer doesn't believe that the warp problem will be corrected." said Mr. Noel D. Jarical, Design and Engineering Manager of RTI.

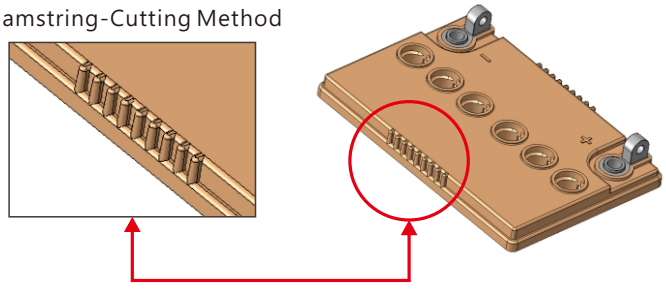
Original Design(Wall Thickness) Revised Design(Wall Thickness)



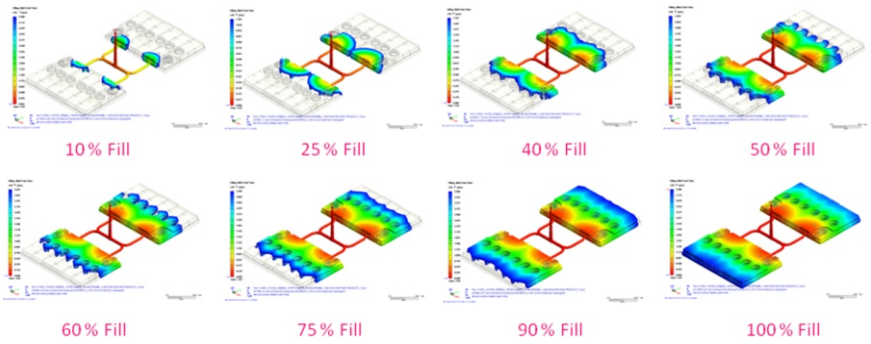
" By that time, Moldex3D was being applied for its capabilities – especially the accuracy and extra high computation performance. We ran this product with modified wall thickness. Simulation results gave a minimal warp and we had shown this to our customer and convinced them to pursue the revision."

Within limited time, RTI completed a number of verifications and showed their technical competency, which combines its experiences with Moldex3D strengths – not only figured out the right direction for revision, but also proved it with solid validations.

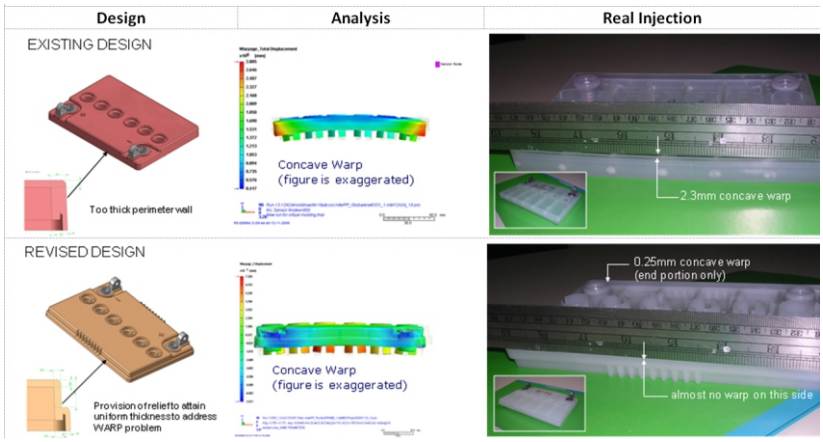
Hamstring-Cutting Method



One of the most obvious differences between traditional trial-and-error and using CAE is we can always accumulate know-how and know-why more systematically and cost-effectively. With the traditional way to verify with real mold trials, huge time and money have to be invested to find out where and how much should be modified.



Time is another concern. With the properly-arranged hardware and Moldex3D unique parallel Computing capability, several true 3D design iterations could be verified overnight after the design team leaves the office. Moldex3D Parallel computing and Remote Computing are two benefits for customers to maximize their hardware performance – and again our time can be saved for creating more values!



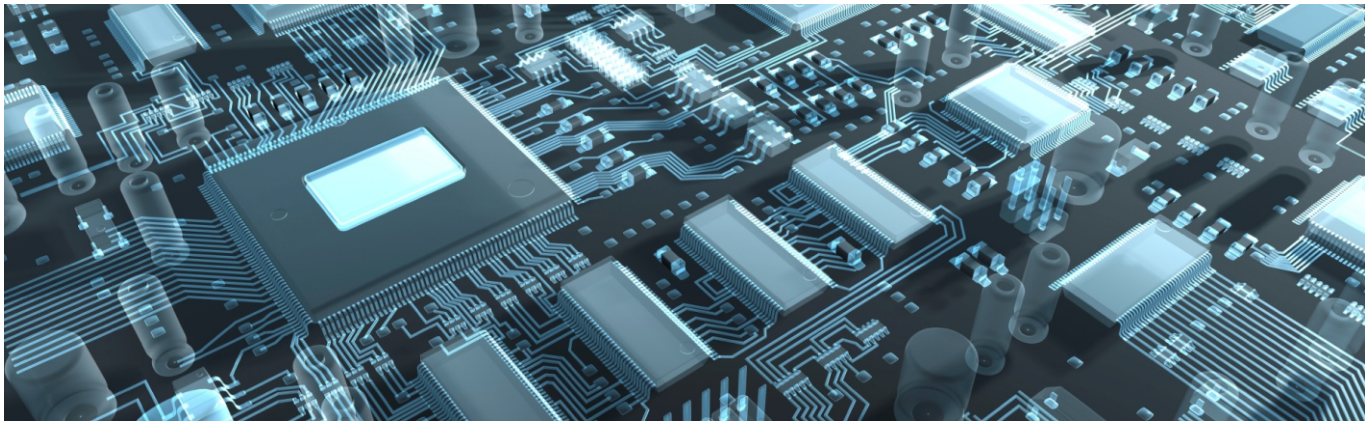
CAE is proven to be an essential technology for improving product quality by many industrial leaders along the years. But besides the more well-known role it plays for improving quality and profitability, domain-knowledge management is becoming a more and more critical lesson for the entire supply chain.

Accuracy and computation performance are what we commit to our customers via Moldex3D – these promises may not be romantic enough, but they are born with real responsibility and respect for what our customers are struggling with. From this Moldex3D successful story, here is the lesson we learned from working with RTI, the leader of automotive battery industry: Turn the Complicate into the Brief; Repeat the Brief into the Critical.

"Actual product gave almost the same results as with the simulation result. We believe that huge time and costs are saved, and the most important is, we further strengthened and proved our core competency. For our customer, RTI stands for the true reliability — we can effectively ensure the high-standard quality (even outperform) because of our knowledge management, not only know-how, but also know-why. This is the win-win RTI created with Moldex3D team."

UTAC Group

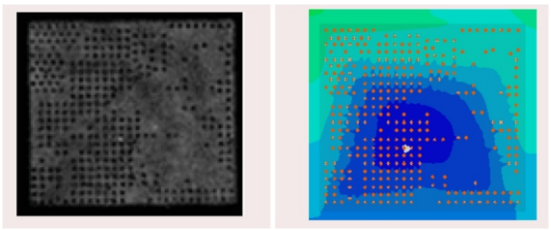
UTAC's Report on Molded Underfill Technology Leveraged on Moldex3D and Won Best Paper of Session in IMAPS



UTAC Group is a leading independent provider of semiconductor assembly and testing services for a broad range of integrated circuits. The Group offers a full range of package and test development, engineering and manufacturing services and solutions to a worldwide customer.

The IC industry is always challenging for thinner packages with smaller footprint. Flip-chip packages have gained significant use in production over the years because of its high inputs/outputs (I/O), enhanced performance and small form factors. Though the flip-chip technology has various advantages over the other high-density electronic packaging approaches, there are rising challenges to ensure moldability and to minimize defects with rapid advances in flip chip technology such as decreasing bump pitch, stand-off height, thinner package profiles and molded underfill (MUF) materials. The complexity was further exacerbated by the possible interactions between these factors and their impact on package yield, reliability and performance. Void entrapment challenges are faced with increasingly small gap at the bumps area under the die, resulting in significant melt front imbalance and flow resistance.

UTAC has employed Moldex3D to setup a virtual molding trial laboratory since 2009. The team has applied it to numerous packaging projects successfully. "We aim to leverage Moldex3D simulation capabilities to solve key problems faced in production." said Ore Siew Hoon, the team leader. "Experiments involving a large DOE matrix are typically used to solve the molding issues, and is very time consuming and difficult because of the complex interactions between fluid flow, heat transfer and polymerization of encapsulant. Numerical simulation is an effective tool for analyzing the complicated physical phenomena" , added Ore Siew Hoon. Recently, the Group's technical paper was proudly awarded the Best Paper of Session in the 44th IMAPS International Symposium on Microelectronics.



The validation shows Moldex3D accurately predicts the air entrapment in the molded underfill package.

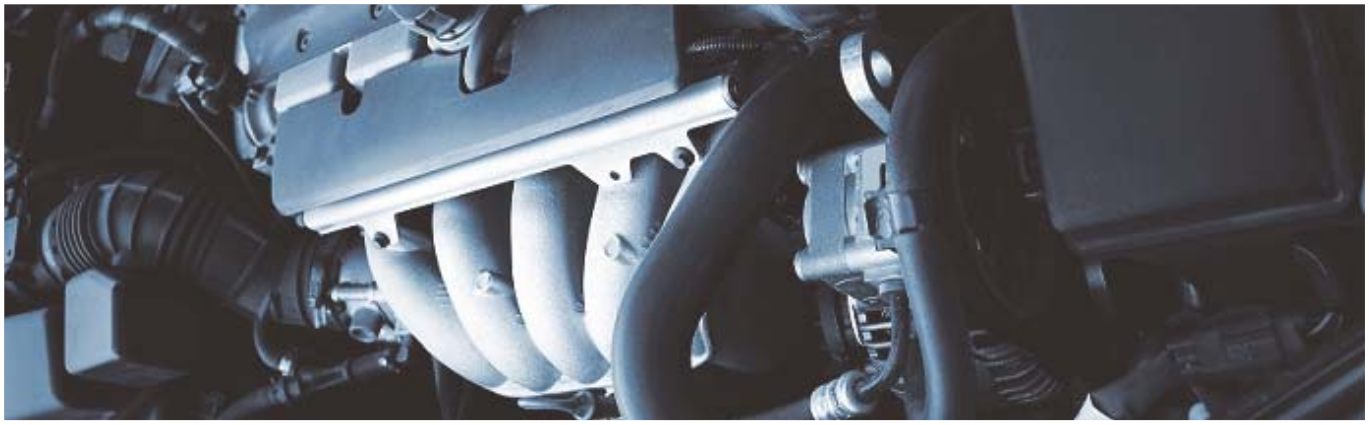
》Customer Profile

The UTAC Group is a leading independent provider of semiconductor assembly and testing services for a broad range of integrated circuits including mixed-signal, analog and memory.
The Group offers a full range of package and test development, engineering and manufacturing services and solutions to a worldwide customer base, comprising leading integrated device manufacturers (IDMs), fabless companies and wafer foundries.

"We aim to leverage Moldex3D simulation capabilities to solve key problems faced in production. Experiments involving a large DOE matrix are typically used to solve the molding issues, and is very time consuming and difficult because of the complex interactions between fluid flow, heat transfer and polymerization of encapsulant. Numerical simulation is an effective tool for analyzing the complicated physical phenomena", said Ore Siew Hoon, the team leader.

Tong Yang Group

Leading Auto-parts Maker Maximized Competitiveness with Injection Molding Simulation



Founded in 1967, the Tong Yang Group is Taiwan's leading supplier of automotive components with a wide range of products. They specialize in both exterior and interior components such as: grilles, front and rear bumpers, door trims, instrument panels, center consoles, door panels and much more. By supplying both OEM corporations and aftermarket suppliers, their 2011 global revenue has grown to more than $10 billion while employing 7,200 workers worldwide. Today, the Tong Yang Group is facing tough competition from auto part manufacturers in China and India, as well as the perpetual concern for lower - cost products and services. In the past, the Tong Yang Group employed the traditional trial-and-error approach to injection molding, which was costly and time-consuming. While using the trial-and-error method, the Tong Yang Group was still expected to enhance developmental capacity to meet their customer's high standards as well as stay ahead of their competition in both cost efficiency and part quality.

The OEM Business Group collaborates with well-known automotive manufacturers to evaluate the manufacturability of their part designs. Then, based on those modeled part designs and 3D numerical analyses, the Tong Yang Group can detect potential problems and offer solutions to prevent costly setbacks.

However, in order to remain competitive in an environment that requires high versatility at low volumes, auto manufacturers are trying to differentiate themselves from the competition by enhancing their vehicle's appearance. Plastic parts such as bumpers, grilles, and aero kits are among the top priorities for appearance changes. These concerns drive the need for simulation software.

Their interior design department uses Moldex3D's simulation analysis on their plastic parts to avoid visual flaws within the part. Since the appearance of interior and exterior parts is the key focus for most consumers, aesthetic quality is paramount. Moldex3D's analysis can help predict the location of sink marks, weld lines, warpage and gaps, all of which would produce visually unacceptable, poor quality parts.

》Customer Profile

Tong Yang Industry Co., Ltd. is principally engaged in the manufacture, wholesaling and retailing of automobile and motorcycle spares parts. The Company provides automobile spares parts and accessories, including bumpers, grilles, engine covers, flap rails, alternators and condensers, among others, as well as motorcycle spare parts and accessories, including wind boards and luggage compartments.

》Key Benefits

Moldex3D's software offers versatile solutions to multiple departments:

- Assisting designers to understand the relationship between part design, mold design, material properties, and molding parameters.
- Lowering development costs.
- Creating product and mold design benchmarks and building learning experiences.

In 2000, the Tong Yang Group adopted Moldex3D's injection molding CAE software to help improve their product development. With significant part quality improvements, the company soon widened its application range. Today, the Tong Yang Group owns 13 licenses of Moldex3D's software, applying it to product designs, mold designs and outsourced vendors. Moldex3D's software offers versatile solutions to multiple departments:

- 》 Assisting designers to understand the relationship between part design, mold design, material properties, and molding parameters.
- 》 Lowering development costs.
- 》 Creating product and mold design benchmarks and building learning experiences.

Optimal mold design solutions can be achieved through Moldex3D's analysis. The results can then be benchmarked and ready for cost evaluation and mold testing. Users can check whether or not the analysis results match real-world performance, and ultimately shorten mold testing time.

"CoreTech is more than an injection molding simulation software supplier. They truly understand the challenges in the molding industry and can always provide us with real-time professional assistance," said Jeff Chien, the director of manufacturing division of Tong Yang Group.

Through continuous design process improvement, Moldex3D can help reduce cycle time by an average of 21.7 seconds for parts such as bumpers. Other products also gain great reduction in cycle time as well. "Our company's productivity has been enhanced by 21.28%, which largely increased our cost advantage. We will adopt simulation analysis among upstream design suppliers, paving the path to collaborative and optimized designs," – Mr. Chien.

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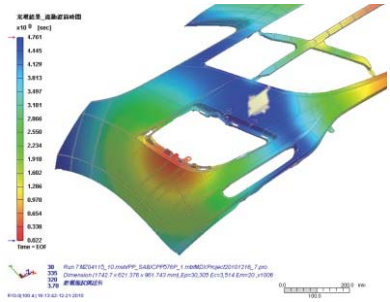
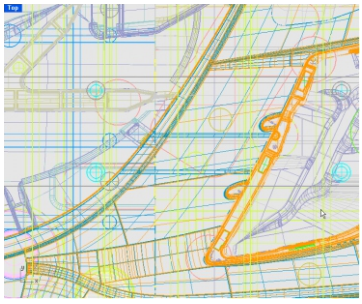


a. Prediction on air trap location venting



b. Place ejector pin in advance before the mold opens for mold

MATSUI MFG. Co., Ltd.

Maximizing Cooling Effects with Moldex3D Conformal Cooling Solution

This case study aims to compare the cooling effect of conformal cooling with the normal cooling design. As shown in the figure below, this model has a very complex geometry. Also, thickness variation is large. With conformal cooling channel design, cooling time was dropped by 10 seconds (33%).

Traditionally, cooling channels cannot be made along with the product geometry, so that the cooling efficiency is limited, especially for those products with complicated geometry. Nowadays, the advanced manufacturing technology has made the conformal cooling possible, However, the verification and optimization of the cooling channel design become more and more difficult because of the complex geometry.

Moldex3D Cooling Analysis can help determine not only the required cooling time, but also the temperature variation inside the mold. Moreover, the coolant behavior such as coolant flow rate, pressure loss, vortex/dead water area can further be estimated by Moldex3D Cooling Channel Analysis. Therefore, it's no longer a problem to optimize the conformal cooling channel design, so as to improve the cooling efficiency.

To help users in conformal cooling, Moldex3D can:

- 》Increase cooling efficiency. With conformal cooling, cooling rate differences can be minimized through the whole part.
- 》Reduce cycle time and cost.
- 》Create better product quality.

First of all, the dimensions of the product are as follows:

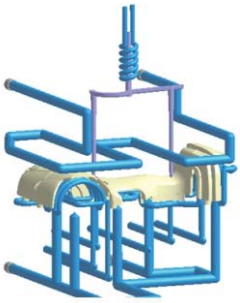
- 》Length:162.23 mm
- 》Width:105.15 mm
- 》Height: 44.51 mm
- 》And the major thickness is around 3 mm

In this study, we are going to compare the cooling efficiency between the conventional cooling design and conformal cooling design. The conventional cooling design has baffle design in the core side, while the conformal cooling design has cooling channels tightly fitting to the product geometry.

》Customer Profile

MATSUI MFG.CO.,LTD.was established in 1912 and main activities revolves around develop ment and production of auxiliaries equipments for plastic molding.

a. Conventional cooling design

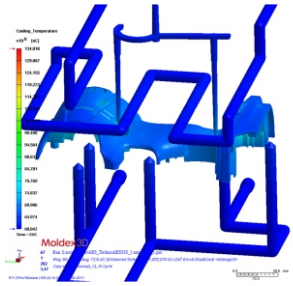


b. Conformal cooling design

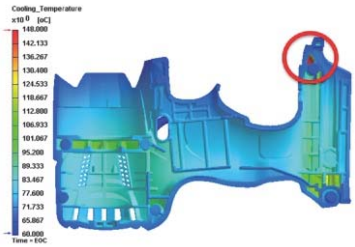
The conformal cooling layout was drawn with same normal distance from the cavity surface to pipe. However, due to geometry limitation, there are still some places unable to locate the cooling lines. The average cooling channel diameter is 4mm; the distance from cavity surface to pipe center is 8.3mm; and the distance between pipes is 9mm.

Here below are the simulation results of these designs:

For the conventional design, the Part surface temperature distribution at the end of cooling is shown as below. The temperature range is from 60.04 to 134.02 ℃. The cavity side has a low and quite uniform temperature distribution; however, at the core side, the part surface temperature differs from area to area. The highest temperature area is indicated by the red circle. It is obvious that no cooling channel goes through this area.

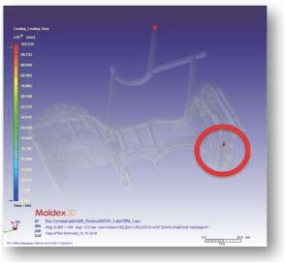


a. Surface temperature is around 57.82 – 129.95 ℃

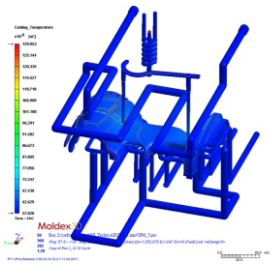


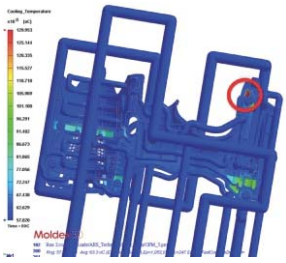
b. Highest temperature is shown in red circle.

The figure on the right shows the required cooling time for the indicated area. The cooling time is defined as the time needed to cool down to the ejection temperature since the end of packing (EOP). As the value estimated is around 101.55 sec, the default cooling time (20sec) may not be enough.

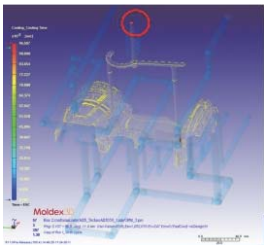


For the conformal cooling, the part surface temperature distribution at the end of cooling is shown as below. The temperature range is from 57.82 to 129.95 ℃, which is lower than that of the conventional design. Besides, it can be seen that the temperature distribution at the core side is more uniform than in the conventional design.





In terms of cooling time, the required maximum cooling time is also reduced to 96.51 seconds.



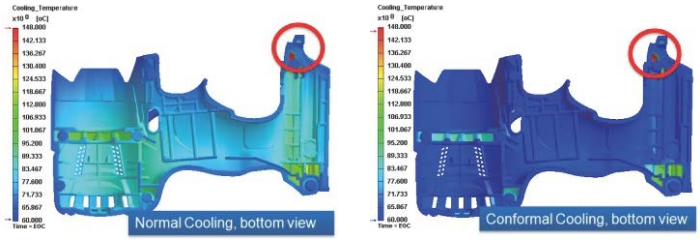
If we set the same temperature range for two cases, we can see that conformal cooling channel effectively removes most of the heat from the core side. However, the maximum. temperature area still exists since no cooling channel passes that area (red circles).

》 The challenge

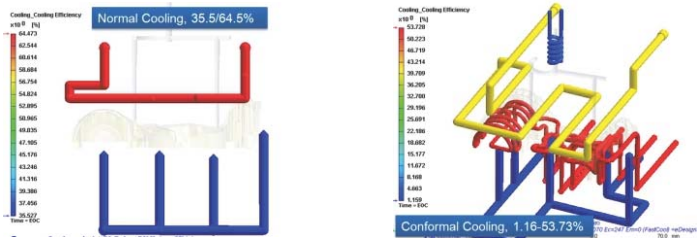
The verification and optimization of the cooling channel design become more and more difficult because of the complex geometry.

》 The Solution

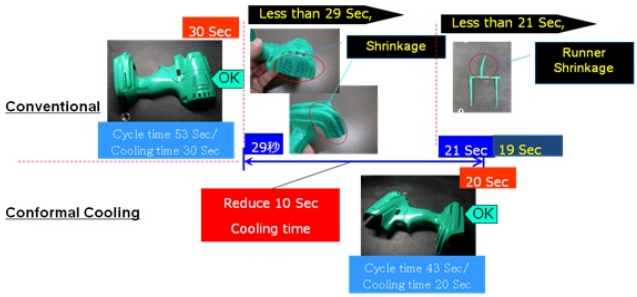
Moldex3D offers a useful tool to help users accurately predict the effects on conformal cooling design.



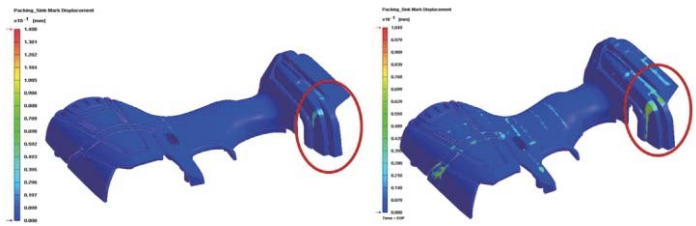
Below is the cooling efficiency comparison. In the conventional design, since the baffle does not reach the core side of the part, the lower cooling channel only absorbs 1/3 of the total heat. On the other hand, in the conformal cooling design, the conformal cooling channel has the highest efficiency (53.73), and conversely, the baffle cooling channel has a very low efficiency (1.16%)



The cycle time is also an improtant issue to be concerned in the cooling design. Compared to the conventional design, the conformal cooling can reduces 10 sec cycle time, or 33 %, while keeping the same product quality.



For instance, the sink mark can be used as an index for the product quality. Below are the sink mark comparisons of the conventional design with 30 seconds cooling time and the conformal cooling design with 20 seconds cooling time. We can see that the sink mark values at the indicated areas are quite the same in these two cases (Normal: 0.07mm; Conformal: 0.08mm).



Displacement 0-0.148mm Displacement 0-0.105mm

In summary, the cooling efficiency of the conventional cooling design is limited, and hard to be improved further because the cooling channel cannot reach the product surface. In this case, we can see that the conformal cooling design can effectively lower cooling time and improve the cooling efficiency while maintaining product quality. Moldex3D offers an useful tool to help users accurately predict the effects on conformal cooling design.

》Key Benefits

To help users in conformal cooling, Moldex3D can:

- Increase cooling efficiency. With conformal cooling, cooling rate differences can be minimized through the whole part.
- Reduce cycle time and cost.
- Create better product quality.

Shadow Polymer Industries Inc.

Industry Leading Plastics Engineering Firm Delivers State-of-the-Art Results Using Moldex3D

Shadow Polymer Industries' customers vary in size from start-up operations through multi-billion dollar corporations. Shadow has an industry leading team of employees and partners to fulfill many needs in a variety of industries. Industries presently serviced by Shadow include: Consumer Products, Automotive, Aerospace, Electrical Components, Food Service, Wireless Communications, Industrial, Medical, Seating, Packaging and Construction. Shadow has utilized numerous software packages over the years for molding simulation analysis and has come to rely on Moldex3D for its precision and accuracy of results. Having confidence in the software utilized is of the utmost importance to Shadow's team, and they have continually proven year after year that Moldex3D is the most reliable, accurate and real-world-based simulation software available in the market.

By using Moldex3D software, Shadow has been able to efficiently and accurately deliver critical information to customers in need thereby insuring that the client is fully aware of the product's capabilities and limitations before the tooling and manufacturing phases begin. Over the years, Shadow has also been able to incorporate Moldex3D into the process of streamlining productivity so customers can save substantially over the course of a product's life cycle.

"With nearly a decade of partnership using Moldex3D, Shadow has experienced higher customer satisfaction and increased profitability for our clients," explains Robert Hickman, President and Chief Engineer of Shadow Polymer Industries. Mr. Hickman continues, "Through the continued partnership with CoreTech and Moldex3D, Shadow remains confident of its ability to provide real-world solutions to our customers by improving product performance, reducing cycle times, and streamlining the manufacturing process. By doing this, Shadow is able to continue its upward growth while maintaining a high customer satisfaction."

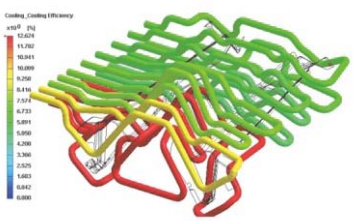


Fig.1 Conformal Cooling

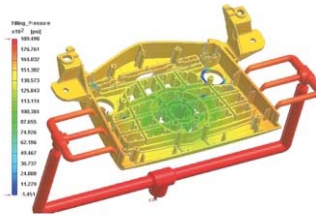


Fig.2 Injection Pressure

》Customer Profile

Shadow Polymer Industries, founded in 1996 by Robert A. Hickman, is a full service design, engineering, optimization, and analysis group dedicated to state-of-the-art product development and advanced manufacturing. They surpass their client's expectations by employing a unique combination of manufacturing experience with advanced simulation technologies to optimize performance and increase profitability. (Source:http://www.shadowpolymer.com.)

Hoffer Plastics Corporation

Hoffer Plastics Successfully Implemented Moldex3D Solutions

The dish washer filter is now currently on the market. Two materials were evaluated for warp and fill. In previous designs, holes were round and cored out from one side. Hoffer's experience with speaker grills and a patented design for manufacturing square holes was utilized. The filter must maintain flatness in both assembly and in application. No residual in-molded stress can be tolerated as in application the water temperature can reach as high as 180 degrees F. Because of this, a flow and warp analysis has to be done in conjunction with the mold design. The cooling line must be modeled into Moldex3D to allow for correct and accurate results to be at attained.

Simulations of grill-like structures have always been very challenging to injection simulations. Traditional approaches require the grills to be modeled as line elements, which is very tedious in modeling and does not provide enough accurate results. Thanks to Moldex3D eDesign, the model can be directly imported from CAD and meshed automatically. All calculations were done at the highest level of meshing in the Moldex3D eDesign program. The model is extremely large and the resulting STL file was 47.5 megabyte. The flow analysis was done at a level 5 mesh and run on a 64 bit workstation with 16 GB of ram and dual quad processors. All 8 processors were utilized for this analysis for best performance.

Multiple analyses were done to determine the best number and placements of the gates to attain the best part fill possible with the least amount of post molding warp. Flow analysis was done on a 4 gate configuration and a 7 gate configuration.

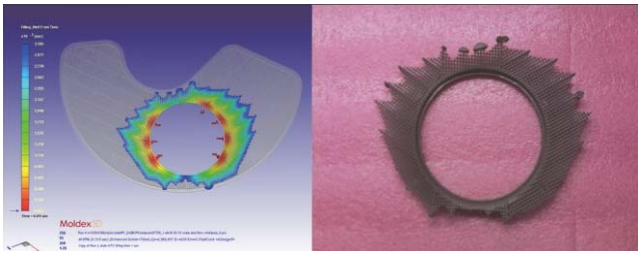
Real Life Results:

The prototype tool initially was manufactured in a 4 gate configuration to compare and confirm the flow analysis results. Next the tool was modified to the 7 gate configuration which predicted a better flow and warp prediction. Also of note the analysis predicted a 1.5mm warp which came out very close. Through part adjustments this was reduced within the part tolerance.

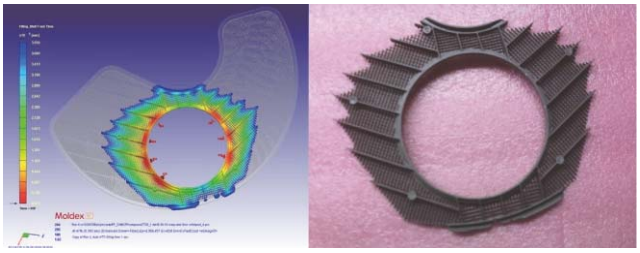
》Customer Profile

Since 1953, Hoffer Plastics Corporation has been an iconic leader in the custom plastic injection molding industry. For over 58 years, Hoffer has manufactured globally for a broad range of customers including the retail packaging, consumer industrial, automotive, medical, and appliance industries.

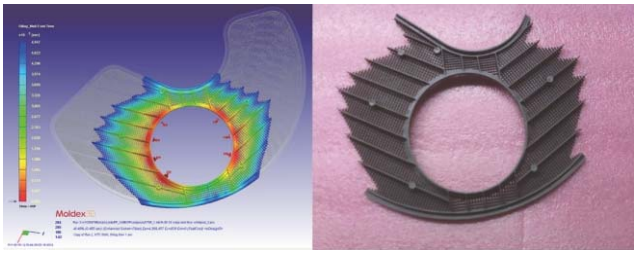
Shown below are the analysis compared to the actual molded parts:



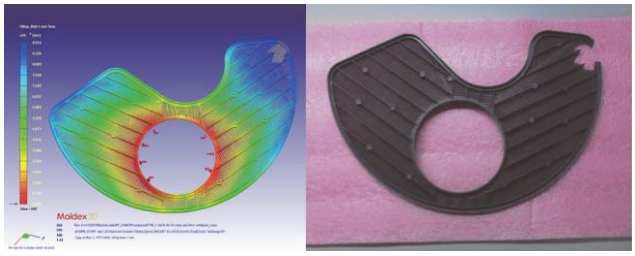
Filling time at 32%



Filling time at 39%

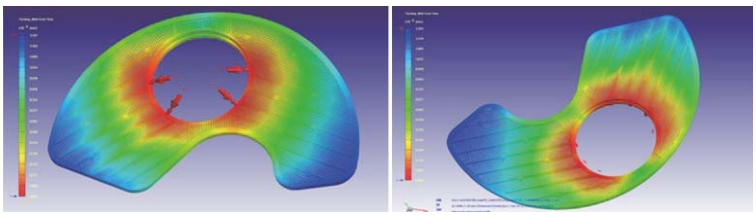


Filling time at 50%

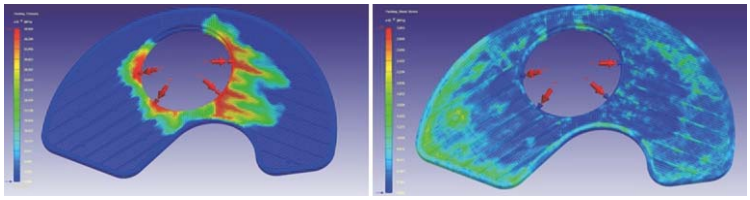


Filling time at 99%

Shown below are the 4 gate vs. 7 gate Melt front time, Pressure and Shear stress analysis comparisons:



4 gate



7 gate

"Since 2007, Hoffer has utilized Moldex3D's engineering simulation software on all new programs to define flow of the plastic and in critical applications warp. Over the last 5 years, Hoffer has run over 600 simulations and gained confidence in the results which supports our continued utilization of the software," said Charles Webster, Product Development Engineer at Hoffer Plastics.

》 The Challenge

Simulations of grill-like structures have always been very challenging to injection simulations. Traditional approaches require the grills to be modeled as line elements, which is very tedious in modeling and does not provide enough accurate results.

》 The Solution

Multiple analyses were done to determine the best number and placements of the gates to attain the best part fill possible with the least amount of post molding warp. Flow analysis was done on a 4 gate configuration and a 7 gate configuration.

》 Key Benefits

Moldex3D eDesign allows the model to be directly imported from CAD and meshed automatically. All calculations were done at the highest level of meshing in the Moldex3D eDesign program.

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Moldex3D

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