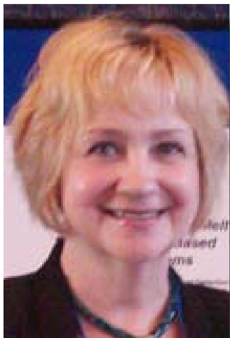
Spring 2012 | No. 89

MOLDING VIEWS

Brought to you by the Injection Molding Division of the Society of Plastics Engineers

Chair's Message



APRIL 2-5 2012: DESTINATION… *ORLANDO*

Save the dates and head south the first week of April 2012!

On Monday, April 2, 2012, the Orange County Convention Center in Orlando, Florida will open its doors to host to two of the biggest events in the plastics industry: NPE 2012 and ANTEC 2012.

NPE 2012 promises to be the largest NPE in history. With over two thousand exhibitors, you will see and experience the latest advances the plastics field has to offer. With so

In This Issue:

This Month's Features:

Chair's Message Continued

many suppliers in one place at one time, you can gather the vital information your company needs to grow business and grow profits. Don't miss this unique opportunity to learn and ask questions about the innovations available in the market to help you compete. www.npe.org

ANTEC 2012 is the single largest technical conference in the plastics industry worldwide. The forums and technical sessions will not only educate, but inspire new ideas that you can share with your teams to do things better, faster, easier and more cost effectively. The SPE Injection Molding Division (IMD) will host twelve different sessions, from Materials to Emerging Technologies. For more information about the ANTEC Program: http://www.npe.org/Attend/content.cfm?itemnumber=7349&navItemNumber=4380

The IMD would like to extend an invitation to all of its members and friends to attend our division's ANTEC Reception on Tuesday, April 3, 2012 from 5-7 PM in meeting room 320AB. Don't miss this chance to network with your industry colleagues.

We look forward to seeing you in Orlando!

Best regards,
Susan Montgomery
Acting Chair, IMD Board of Directors

Industry Events Calendar

March 2012

March 29
FLEXPO - Houston 2012
Houston, Texas USA
www.mtconnectconference.org

March 227-29
WESTEC 2012
Los Angeles, CA
www.westeconline.com

April 2012

April 1-5
ANTEC 2012
Orlando FL
www.4spe.org

May 2012

May 06
ROTATIONAL MOLDING® 2012 CONFERENCE
Cleveland, Ohio
https://netforum.avectra.com

May 16
2012 SPE BIOPLASTIC MATERIALS® CONFERENCE
Seattle, Washington
www.4spe.org

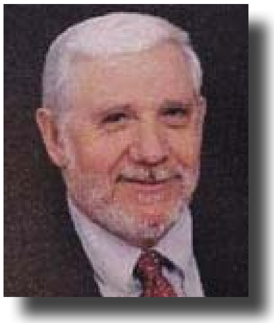
May 22- 25
RAPID 2012 CONFERENCE & EXPOSITION
Atlanta, GA
http://rapid.sme.org

Click the show links for more information on these events!

Ask the Experts: Bob Dealy

Injection Molding Questions

Cost Concerns



Bob Dealey, owner and president of Dealey's Mold Engineering, Inc. answers your questions about injection molding.

Bob has over 30 years of experience in plastics injection-molding design, tooling, and processing.

You can reach Bob by e-mailing molddoctor@dealeyme.com

Q: I'm in the process of designing a box shaped part to protect delicate low voltage optical instrumentation. The flexural strength of the box sidewalls is paramount to prevent damage of the optics in shipment and external appearance is unimportant. What are some of my options? We plan to use a Polypropylene copolymer and warp is of concern. The cost of the mold is another concern.

A: Assuming that your box can be of any shape, the square sided box illustrated in **Figure** is the least costly for the mold build. However, warp and flexing are highly probable.

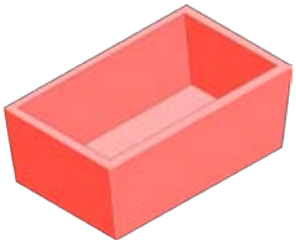


Figure 1

Adding crowns to the side walls will reduce the amount of warp drastically and will also improve deflection by outside forces **(Figure 2**). This will result in a slightly higher mold cost and a little more material will be required, but the injection molding cycle will remain the same and/or be reduced due to the contour.

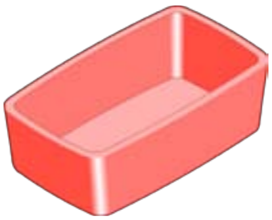


Figure 2

Ask the Experts: Bob Dealy Continued

The addition of part detail to the side walls will greatly enhance deflection inward and add considerable stiffening for the prevention of warp. (**Figure 3**), illustrates an example of using a stiffing detail, while maintaining a constant wall thickness. However, the cost of the mold will increase substantially and additionally, material cost will be greater.

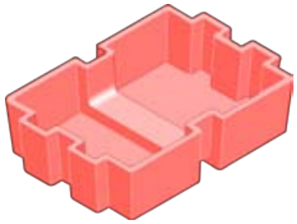


Figure 3

The design illustrated in **Figure 2** is possibly the best choice. The shape will work well in resisting warp in copolymer PP. The mold cost increase will mainly be the result of not being able to grind the straight core side walls, resulting in more benching time. With out having to be concerned about holding the side walls straight (as in **Figure 1**), a reduction in part cooling time could result in a lower piece part cost.

Another concept would be to add vertical ribs to the interior, exterior or both for strength. However, inward warp of the side walls would not be alleviated. Attachment means for some type of cover, such as standing bosses attached to the corners with a rib, would be the same in either of the examples shown.

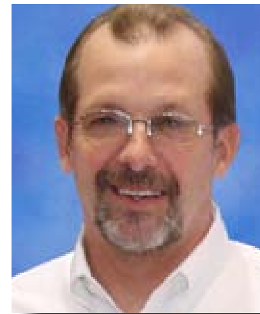
As always, comments from the readers are welcome and can be sent to: Bob Dealey, MoldDoctor@DealeyME.com

Bob Dealy *Dealy's Mold Engineering*

Ask the Experts: Steve Johnson

Mold Maintenance Questions

Data? What Data?



Please submit any questions or comments to maintenance expert **Steve Johnson**, *Operations Manager for ToolingDocs LLC, and owner of MoldTrax.*

Steve has worked in this industry for more than 32 years. E-mail Steve at steve.johnson@toolingdocs.com or call (419) 281-0790.

Q: I'm under pressure, as a new maintenance manager, to improve mold maintenance efforts in our toolroom. I also have to report the results to the corner office. Is there anything I can do to quickly make things better and show improvement?

A: I just got off the phone with a potential client who asked this very question. He was searching for a silver bullet that would make it all better.

One of the first questions I always ask a person in this predicament is what they would like their maintenance system to do for them. In other words, what kind of data do you want to collect and how would you like to use it – and how would you like this data presented back to you?

As with many before him, he did not know. His background and experience in mold building was lengthy and impressive. But from that first day as a maintenance manager he quickly learned that this was a different kind of animal when the flames of unscheduled breakdowns rise up. The only effective relief is to smother the fire – with more money. As much as he wanted to work pro actively and methodically, like he did when he built molds, there just seemed to be no other way to run the shop, and he did not understand what kind of data could help him change the culture.

Not the Lone Ranger

I explained that he was not alone. Many companies still do not analyze maintenance data because they haven't collected enough to establish a viable baseline. This is because the normal mode of mold maintenance operations requires a toolmaker to type (hunt and peck) or write (illegibly) what was done (using non-standard terms) into a text field of a work order system. This antiquated practice has toolmakers spending way too much face time with a computer screen, so to shorten this stay, most would end up just typing in "Fixed it" or "Done" and leave it at that. Not much usable information here.

Ask the Experts: Steve Johnson Continued

So with this being the main record of the repair, not only are the unscheduled breakdowns catching most toolroom supervisors off guard, but molds having typical cycle-based PMs performed on them are a surprise as well because you never know what you will find until you get it disassembled. So ongoing issues don't get repaired; instead, they get a Band-Aid, which further feeds the firefighting culture.

Burned Out?

Among its other bad consequences, firefighting seems to have an incredible numbing effect on the brain. When the smoke eventually clears, and it always does for a time, it is practically a cause for celebration. So looking for signs of the next fire sounds like wasted time because the clues are too hard to follow. They are hidden in the ambiguous entries of the text fields of your work order system and no one will peruse and decipher those just to look for trouble.

So when you ask a maintenance supervisor with a firefighting background what knowledge about his molds would help him run a more effective and efficient shop, it usually causes him to stop and scratch his head because being proactive requires one to take the initiative rather than reacting to events or breakdowns.

However, before you can take the initiative, you must have a plan that centers on reducing or eliminating the reasons for the breakdowns in the first place. Creating a maintenance plan is based on what you and your mold repair techs know about each mold's performance and maintenance characteristics and past repairs. The more detailed and accurate the information, the more effective and efficient the repair will be.

Different Molds, Same Problems

Obviously there are many different kinds of molding operations in existence today. Mold styles, resin properties and products have no effect on the methodology of a maintenance strategy. Those of you who, like me, have spent considerable time and effort "fixing stuff" realize that all things mechanical are corrected with the same methodology, regardless of the apparatus or application. The bottom line is "if you run it, it will wear".

So the methodology behind the repair is this:

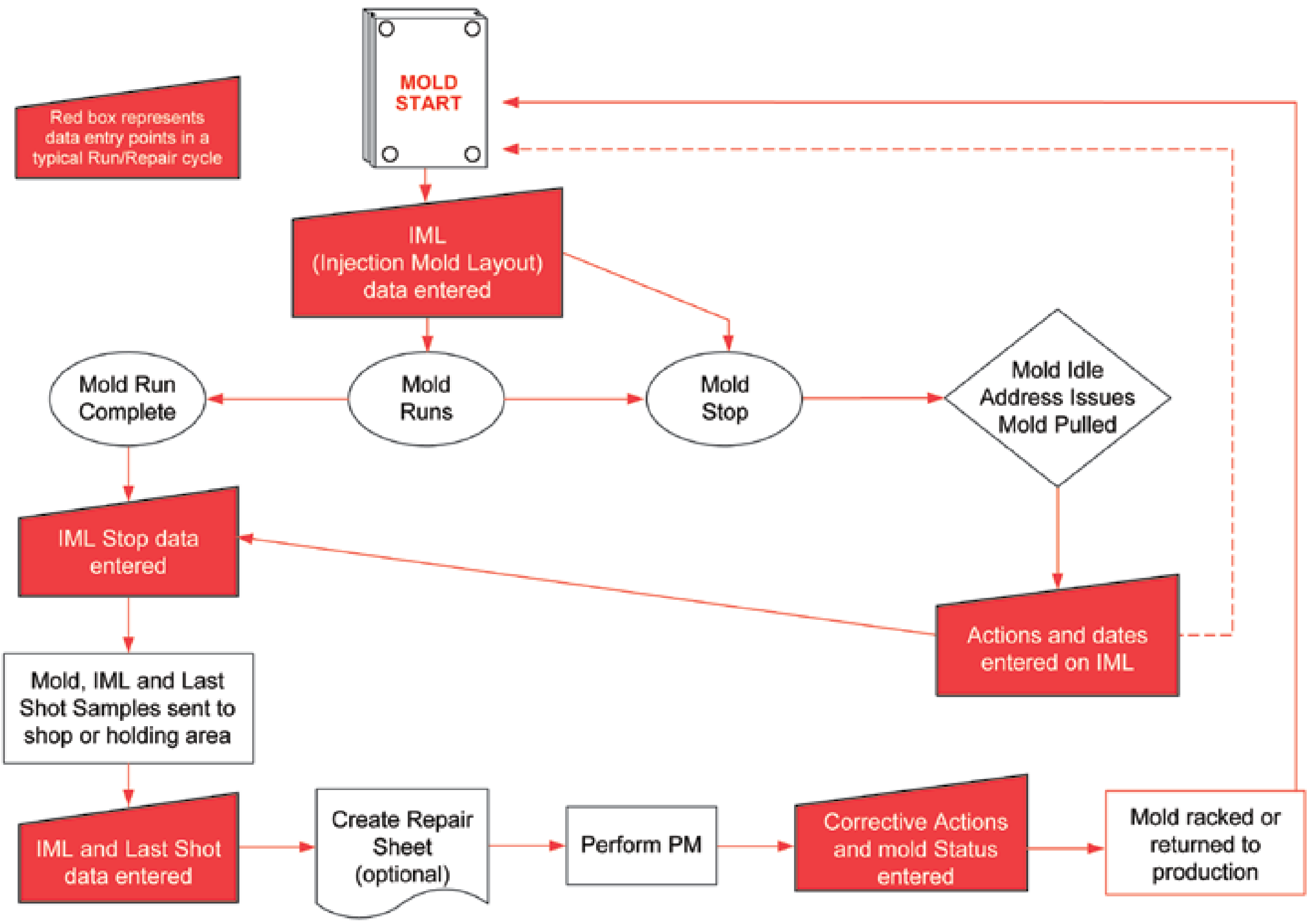
The mold runs (cycles) which creates wear that translates to product or mold defects (flash, broken tooling, mismatch etc.).

Each defect then gets:

- Categorized (electrical, maintenance, process, etc.)
- Named (standard term)
- A probable cause(s)
- A corrective action directed toward each probable cause
- Preventative action (if known) to eliminate or reduce the defect frequency.

Ask the Experts: Steve Johnson Continued

Typical Mold Run / Repair Cycle



Interested Parties

There are different groups of individuals in plastics manufacturing that are responsible for the steps from part inception to production, and many maintain an interest in the mold throughout its life cycle. Each of these groups have a vested interest in how the mold performs and they look at data differently to determine a course of action based entirely on meeting immediate and longer term production goals, which is what growing a profitable business is all about.

Ask the Experts: Steve Johnson Continued

Troubleshooting Flow Chart

Ask the Experts: Steve Johnson Continued

Here is a typical example of a plastics manufacturing job description:

- Tooling engineers usually oversee the design and building of molds.
- Production supervisors and managers are responsible for getting product out the door.
- Process engineers/managers usually oversee the presses and running of all molds.
- Process technicians start and cycle in molds and troubleshoot during the run.
- Tooling or mold shop supervisors and managers are responsible for the daily mechanical performance and maintenance of molds (performance meaning the mold runs/functions as designed—and sometimes as needed).
- Repair technician/toolmakers are held responsible to make all the above dreams come true… in the short term, just make them run.

More than Just Shop Culture

Obviously there can be many off-shoots of these positions depending upon the company's products and size, but these are the main players that would benefit from accurate maintenance data.

All of these departments suffer when the wrong mold goes down at the wrong time. The damaging effect of sporadic and ineffective mold maintenance can have a rippling effect through a company's profit line from many directions—such as critical production being shut down, product quality complaints, tooling and labor budget blow-outs and an overall inability to maximize capacity or create new business.

The Changing Face of Maintenance

As this generation of true craftsmen fades away, there is a slow realization that they are not being replaced as quickly as they left. Why didn't we see it coming? Because our dwindling talent pool was hidden by lean and other manufacturing strategies that have maintenance shops scrambling to improve methods so that one person may now do the work of two, three or four.

Unfortunately, the staple of our maintenance culture—firefighting—is not a method enhanced by reducing headcount. And this only makes sense. Would you knock a fire down quicker by reducing the amount of water being applied? Hardly. Fires are extinguished by targeting the source of the fire and they are eliminated by understanding the cause of the fire.

But before you can target the source

Ask the Experts: Steve Johnson Continued

of a new fire, one needs to see it more clearly, and before you can stop an old fire from reigniting, you must be able to recognize the conditions that create the potential for combustion.

Band-Aids Will Wash Off

A typical firefighting quandary is how quickly we can get the mold back into production, so the resultant toolroom question then becomes: "How long will it need to run to fill the order?" The answer dictates the type and quality of the ensuing repair. "Let's do it right the first time" is not a common mantra in mold maintenance.

So proactive maintenance, meaning analytical troubleshooting of mold issues both in the press and on the bench, is not practiced and is seldom considered because there always seems to be more "in your face" issues to deal with around the clock.

To aid in understanding what kind of mold data the aforementioned departments need to do their jobs more effectively, the next article will deal with dissecting the different data types and who should be responsible for collecting and analyzing specific information and how this should be done.

Steve Johnson *is Operations Manager at ToolingDocs, a leading authority on mold maintenance and training. Steve can be reached at Steve.Johnson@ToolingDocs.com or visit www.toolingdocs.com.*

Do You Have Question or Problem You Need Resolved?

If you have a question on MOLD MAINTENCE?

E-mail Steve Johnson at steve.johnson@toolingdocs.com

Ask the Experts: Terry L. Schwenk

Hot Runner Tips

This issue will explore some hot runner tips, rather than questions. I have two tips. One revolves around material residence time in the hot runner and the other revolves around removing nozzle tips without damaging the threads.

The purpose of this column is to provide valid information concerning hot runner technology. We invite you to submit questions or comments to our hot runner expert, Terry L. Schwenk has over 36 years of processing and hot runner experience. Terry is currently employed with EWIKON Molding Technologies and can be reached by mailing: terry.schwenk@ewikonusa.com.

Tip Number One:

Processors often observe that material degrades in the hot runner but when they calculate the residence time it only shows there are maybe 3 shots of material in the hot runner at one time. And with a 15 second cycle the material should only see 45 seconds residence time. So how can the material degrade?

The answer is plastic materials have laminar flow. The center of the melt flows at a higher velocity then the outer regions of the melt channel. So the center material may only see 2 shots rresidence time, but the outer regions could see 7 or 8 shots residence time. How the material flows through the hot runner determines true residence time and is very much material and process dependant.

Material viscosity properties are affected by the flow velocity. So the rate of material flow through the hot runner system will have an effect on the residence time. The size of the bore channels in the hot runner has the same effect. The simplest way I have found to ac-

Ask the Experts: Terry L. Schwenk Continued

curately measure true residence time in the hot runner is this;

Establish your process. At this point, stop the molding process, pull back the injection barrel and insert at the melt entrance of the hot runner some colorant different than the material color you are running. Move the injection barrel forward and begin the molding process. Start counting the number of shots before you start seeing color coming through. At that point start counting the number of shots before the color is gone. The combined total is the true residence time of the hot runner.

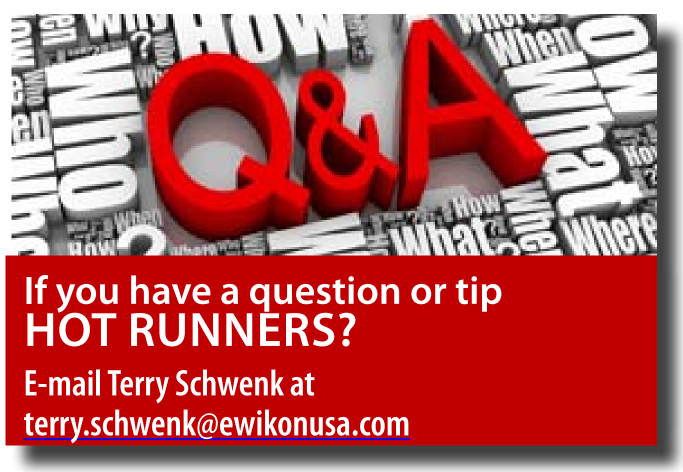
Tip Number Two:

Anyone who has had the pleasure of removing or replacing tips off a hot runner nozzle has experience at one time or another crossed thread. I can't say this tip will 100% eliminate the cross threaded tip, but it drastically reduces the chances of a crossed thread.

First of all (do I really need to say this) use anti-seize compound. You should avoid copper based anti-seize compounds as they can have an adverse effect and when mixed with some plastics materials or additives can cause corrosion of your nozzle and seals making it impossible to remove the tip without cross threading. I highly recommend silver based anti-seize, some of which are also FDA approved. Second choice is nickel based anti-seize. When removing tips you should always heat the nozzle to its processing temperature. There are two reasons for this. One is if a leak has occurred there will be plastic material in the threads and you want this plastics to be molten when trying to unscrew the tip. Secondly, some hot runner manufactures have you heat the nozzle to install the tips. Reason is the nozzle will expand and at processing temperature the thread area of the nozzle has expanded. With the tip torque in place and when the nozzle cools down, the nozzle will shrink around the threads locking them in place and a cold removal at this point will result in a crossed thread. So there you have it, heat up the tips for removal and use silver based anti-seize.

Please keep those hot runner questions coming. And if you find these tips useful, let me know and I will add tips in future articles. Also if you have any hot runner tips, let me know and I can also add them to this column.

Terry L. Schwenk *EWIKON Molding Technologies.*



Terry Minnick, Consultant
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To Sell or Not to Sell
Things to Consider When Selling a Business

A quick overview of how to get the highest value for the business that you have worked so hard to build.

As the owner of a plastic processing operation, you may never sell a company until you decide to retire. So while you may be business-savvy and very good at running your company, you are not likely to be familiar with the process of selling a business. In order to avoid some very costly mistakes, you should rely on some professional help from your accountant, your attorney and a qualified business broker or M&A advisor. Together, these people will be your TEAM.

But if you are just "thinking" about selling his business, there are still some very important things to consider several years in advance of your exit. If you are an owner and you are beginning to think about selling, here is a quick overview of how to get the highest value for the business that you have worked so hard to build:

The number one factor that influences the price of a business is its financial performance and, most especially, its cash flow. Do what you can to raise prices, bring on a new piece of business, cut extraneous costs and slim down the organization.

Make Sure yYou Have a Strong Management Team.

If you are very hands-on and indispensible to the business, buyers will take note of this and will discount the value of your company. Have a strong team in place, including a great operations manager and a talented sales manager and make sure they are the first line of customer contact.

Avoid Customer Concentration.

If you have one customer who is more than 25% of your business, now is the time to fix that situation. Bring on some new business and dilute that big customer. Buyers discount the value of companies with high customer risk.

Feature: When to Sell Your Business Continued

Try to Achieve a Focus or Identity for Your Company.

If you are an undifferentiated custom molder, your value is less than if you are a medical molder, an automotive molder, an insert molder, etc. Try to pick what you are best at and focus on growing that part of your business.

Talk with your attorney and accountant about the tax status of your company and the implications on net after-tax sale proceeds. There are advantages, when you sell, to being an S-Corporation or LLC but, in most cases, you have to change your status well before the selling process begins.

If you own your real estate, it pays to be flexible. Some buyers like to lease the real estate while others prefer to buy it. If you can go either way, it will help your valuation.

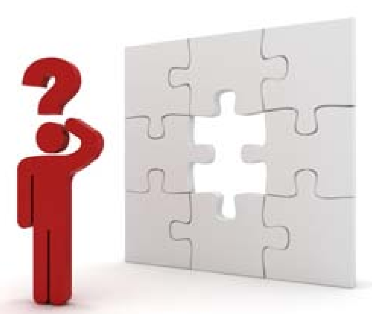
Timing is Very Important.

It is hard to sell even a good business when the economy and/or your own business is trending down. Don't try to time the market perfectly. It is hard to do. Just sell when your business is growing and the immediate future looks bright.

If you follow these guidelines and have a good team (accountant, attorney and broker) backing you up, you will sail smoothly through the process of selling your company and can retire knowing that you got the best value possible.

Terry Minnick *is a Chemical Engineer who started his career at Dow Chemical in the resin business and then bought a custom molding company. He tells his friends that he lost most of his money and all of his hair in the plastics business. Now he and his partners own a consulting company that does merger and acquisition advisory, commercial consulting and executive recruiting – for the plastics processing industry. Terry J. Minnick can be reached by phone at (413) 584-2899 or through e-mail terry@moldingbusiness.com. Visist www.moldingbusiness.com for more information.*

If you have a question on business stategies contact



Terry Minnick at
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By Jorge Aisa, Javier Castany, Angel Fernández*, T.I.I.P. – Unidad Asociada al CSIC
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Sequential Injection Molding: Design Considerations

New injection processes have been developed over the last decades, improving the designer freedom in order to launch attractive functionalities. All these procedures should be carefully analysed before to decide their use, because it is necessary to understand their natural restrictions, cost and operation requirements and rheological implications in the tools construction. This contribution presents a wide study made in the T.I.I.P., research group from the University of Zaragoza, which gives simulation results and experimental values about sequential injection moulding, and some practical considerations for designers and toolmakers, in order to get successfully results.

Injection molding is the most extended technology to create new plastic parts due to its wide possibilities adding additional value to final user (e.g. combining soft and rigid materials, including living hinges, etc.). New processes have been developed during last two decades and most of them became popular in few years, reader can revise a clear classification of these methods in [1].

Sequential injection molding was born in the 80´s when hot runner systems reach maturity. It facilitates to incorporate decorative film or textile into molding components, but it is widely applied for big automotive parts in order to avoid welding lines. In other ways, family molds use the gate opening looking for balance the filling phase and reduce overpacking effects.

Sequential injection basis is relatively simple: different gates open at different time, depending on a desired effect. For big parts and molds, usually weld lines created between adjacent gates are the main problem, and they could be eliminated. The elimination of weld lines allows introducing a greater number of entry points, which leads to a reduction flow path and the injection pressure.

As usual in other engineering fields, new developments are easily considered as the best solution, and technical staffs do not consider always the physical principles and new risks in a proper way. For example, sequential injection is commonly cited as "low pressure procedure" [1-3], or it is accepted that "it reduces clamping force" [4].

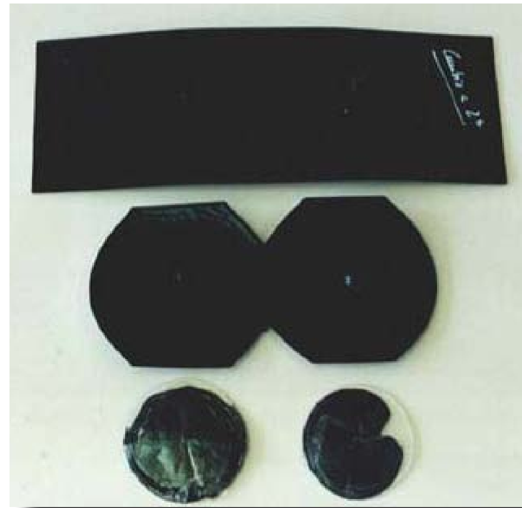

Figure 1: Conventional filling of parts used for this work.

Figure 2: Sequential filling of part used for this work.

Materials and Method

The experimental work is described below, in order to introduce basic principles of sequential injection. A hot runner mold was manufactured, with two injection valve gates. Mold plate dimensions were 596 x 496 mm. The injected part was a 2 mm thick rectangular plate, 450 x 150 mm, and the distance between gates, centered in the width of plate was 150 mm. The hot runner system was provided by Mold-Masters and valve pin cylinders were operated using an independent and computer-controlled hydraulic unit.

A polypropylene (PP) resin was used for the experimental work, a usual automotive grade for bumpers with EPDM, and it was produced by DSM. This resin had a solid density of 0.90 g/cm_3. The melt index (MI) for the resin was 0.6 dg /min (230°C, 2.16 kg, ISO 1133), and a complete properties set was taken from the C-Mold software. To the observation by photoelastic techniques of residual stress in the process, some samples were made also with PS, produced by ENICHEM.

The mold was equipped with three pressure sensors type 6157, provided by KISTLER, in order to register specific pressure inside the mold, and the acquisition software DATAFLOW. At the same time, hydraulic pressure was recorded for each injection shoot using another piezoelectric KISTLER 4095A connected with the same computer device. A MATEU&SOLE 340 ton injection molding machine did the plastic parts.

Injected parts were weighted and classified, and different halterio samples were prepared from two different locations in the part, one just between injection gates and affected by welding lines in conventional process, and the rest of the samples were taken near to the second gate in conventional process to investigate the effect of polymer flow when this gate is opened. Both positions were chosen in order to compare mechanical properties of manufactured parts in both cases, conventional and sequential injection molding. The strainstress curves were made using an Instron machine with high resolution extensometer.

In the other hand, several typical parts made with sequential injection were simulated using commercial code as C-Mold (nowadays integrated inside Autodesk package). These tests allow investigating how sequential filling can affect the mold design or the practical setting up in the manufacturing plant. A front bumper will be presented in this work. However, other shapes were observed, as a linear protection or a dashboard. In all the cases similar conclusions were reported.

Experimental Results

Figure 1 shows the conventional filling, while **Figure 2** shows the filling sequence. Conventional filling of this rectangular part creates a central weld line, meanwhile in sequential injection the first gate fills the cavity until it reaches the second gate. Figure 2 shows that the second gate continues the melt front after opened.

An initial consideration should be done on the properties of the piece: the one made by sequential injection shall be an asymmetric behavior, since the form of filling pressure and conditioning the subsequent behavior. This phenomenon could be observed using photoelastic stress analysis, as it is shown in **Figure 3**. Two styrene samples with asymmetrical stress arrangement were captured. The most packed part suffers the most residual stress and plenty of isocromatic lines. Furthermore, residual stress or mechanical properties of polymer to its use, in the author´s opinion, shrinkage differences could be anticipated [5].

Figure 3: asymmetrical stress distribution for two sequentially injected parts. Upper gate was opened first. Left: packing pressure 20 bar; right, packing pressure 35 bar.

The samples produced by conventional injection showed a brittle fracture for the different conditions tested, with elongation values below 10%, while all other samples, regardless of the location process and showed ductile fracture elongation values above 200 % and corresponds to a PP blended with EPDM [6]. **Figure 4** shows how samples cut from conventional parts show brittle fracture for weld line location and ductile failure for other area.

Figure 4: Tensile stress samples after test: brittle fracture for weld line area, ductile failure for other location. This second behavior was encountered for sequential injection specimens.

Injection pressure required to complete the sequential parts were higher than value registered for conventional in all experiences (**Table 1**). This value is explained due to the longer flow length that appears in sequential injection.

This result motivates, in author´s opinion, to re-evaluate sequential injection as "low pressure method", at least without additional remarks. This statement could be considered only if introduced some new points of injection into the piece, which means more investment and more delicate maintenance process.

Feature: IM Design Continued

MELT TEMPERATURE	FILLING TIME	MAXIMUM HYDRAULIC PRESSURE CONVENTIONAL PROCESS	MAXIMUM HYDRAULIC PRESSURE SEQUENTIAL PROCESS
215ºC	1 s	55 bar	69 bar
230ºC	3 s	44 bar	49 bar
230ºC	3 s	43 bar	53 bar
230ºC	1 s	53 bar	66 bar

Table 1: Maximum hydraulic pressure results for the rectangular part used, under selected conditions, conventional and sequential process with PP+EPDM.

RESULTS	3 GATES, BALANCED CONVENTIONAL CRITERIA	3 GATES, MORE SEPARATED	3 POINTS, EQUAL LENGHT FLOW
CAVITY PRESSURE REQUIERED (MPa)	131	113	101
CLAMPING FORCE CALCULATED DURING FILLING PHASE (Ton)	430	630	700

Table 2: Maximum pressure and clamping force results simulated for typical injection conditions, sequential injection of a bumper part with PP+EPDM..

Mold Design: Learned Lessons

Plastic part design requires an effective knowledge on manufacturing process and tooling restrictions. In injection molding, due to it special capabilities (undercuts for example), this integration of different subject items is especially critical. Simulation software can help the designers and its accuracy in pressure and clamp force calculation, and it is commonly accepted if a proper model and a good material data is available.

In this point, from several analyses of different geometries, authors can offer two basic considerations in order to prevent great mold design defects:

a) New balance concept to arrange injection gates:

It is well known that gate position determines pressure distribution inside the mold, and in the same way, it affects strongly clamping force required. The basic criteria for big parts which needs several injection gates is to place them equally separated in order to divide the plastic flow in as many volumes as gates provided. However, in sequential injection molding this criterion is not adequate, because the consecutive gate opening changes the melt front advancement. In this way, a new arrangement considering equal flow length for each gate is proposal as the best choice, following [7], as it is shown in **Table 2** for a bumper part.

b) Consideration about hesitation effect for rear flow areas:

The consecutive gates opening introduce a variable flow rate during injection time, because when a new valve is opened, plastic flow suddenly suffers a decompression, because it has no plastic in front of it. This effect is recorded in the hydraulic pressure, where several peaks could be observed [8]. But, in addition, a hesitation effect is introduced in the mold filling because areas at the rear of the new flow front will not receive

Feature: IM Design Continued

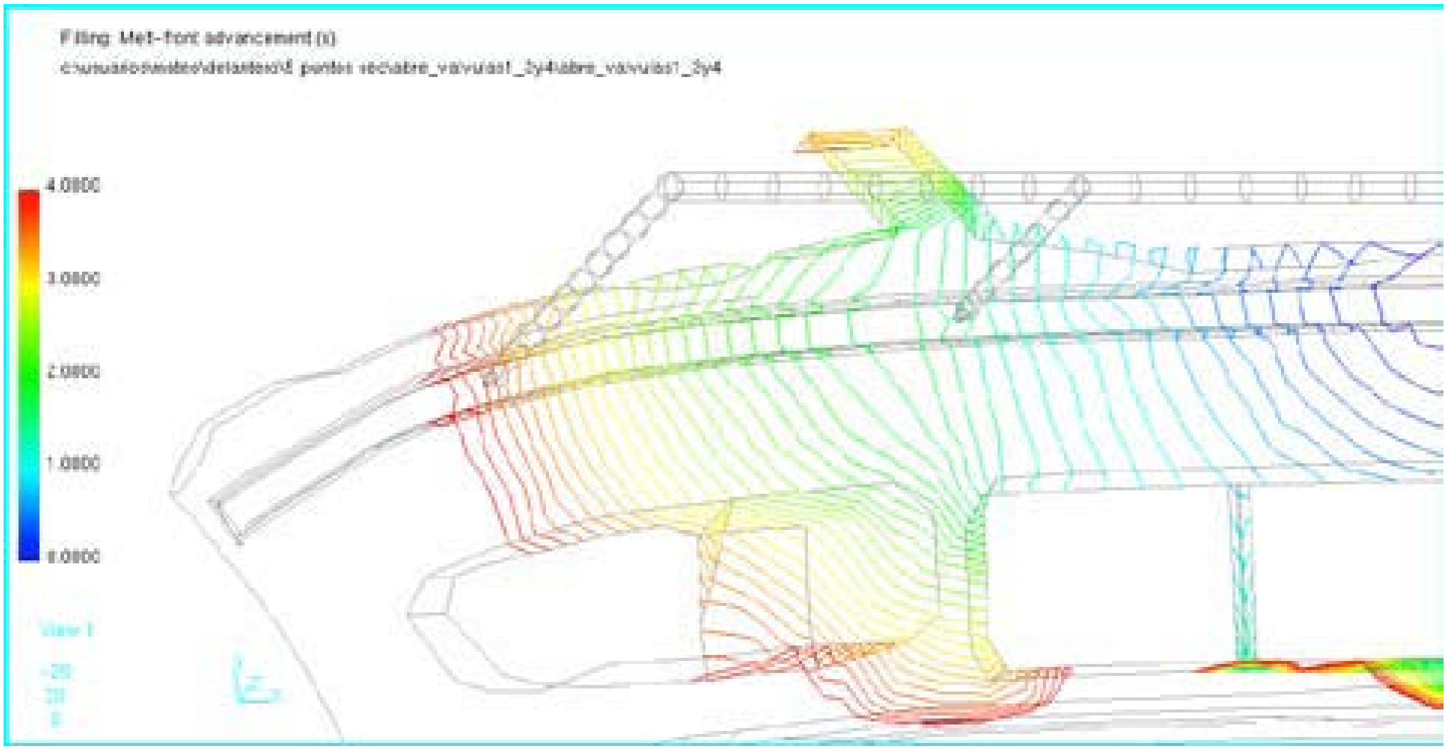

Figure 5: Hesitation of melt front advancement in a bumper injection using sequential injection. The bottom of the part is not filling through central gates, but from the lateral ones

plastic from the barrel when the next gate is opened. In **Figure 5**, readers can observe how the bottom area of a rear bumper will not be filled if designer does not consider this phenomena.

An additional injection point solves this hesitation effect, (**Figure 6**) but, under "a traditional point of view", it would be no necessary this extra investment. Notice that if a conventional criterion is used, mold can produce non-useful parts, and a later re-design not always will solve the flaw, especially for complex parts.

Setting up Cautions

In addition, an important remark should be done in order to understand the setting up of sequential molds. During the mold filling process, the flow rate is introduced by the schedule of the screw speed, and it is common to use a profile with the first stage slow down to prevent streaking or surface defects related to an elevated shear stress.

The same fact is reproduced in sequential injection each time a new gate opens, the flow rate being introduced into the mold and that was distributed over a large bore, it is forced to move through the new entries opened. That is why it is necessary to consider the necessity of a programming filling phase much more complex, including screw speed reductions at intermediate points.

This fact needs for greater control of the settings, the more skills of the operators and major setup times and tuning of production, which necessarily will involve an extra cost to the investment made. Figure 6 shows the high shear stress values calculated using commercial software. This evidence was checked with several producers and the staff of Fundación aiTIIP (www.aitiip.com), research and technical center born as spin-off from the University of Zaragoza, from the TIIP group. All of them explained that this assessment was really used in their plants and mold test procedures.

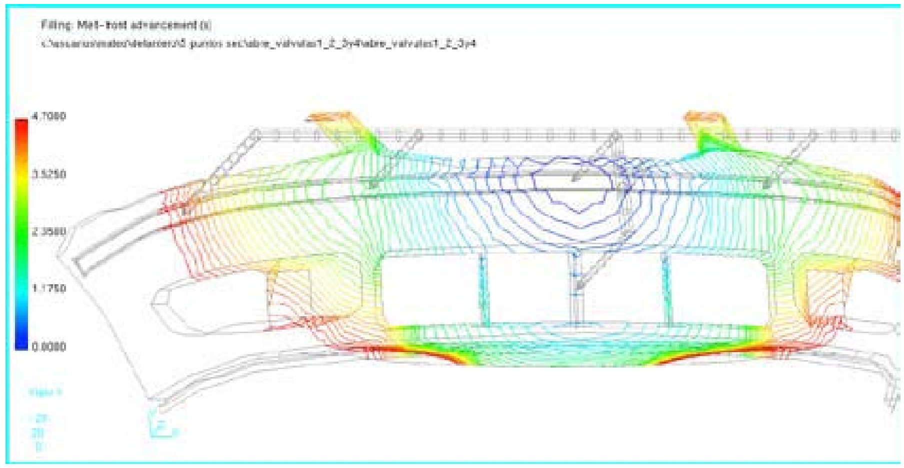

Figure 6: Additional central point eliminates this hesitation effect

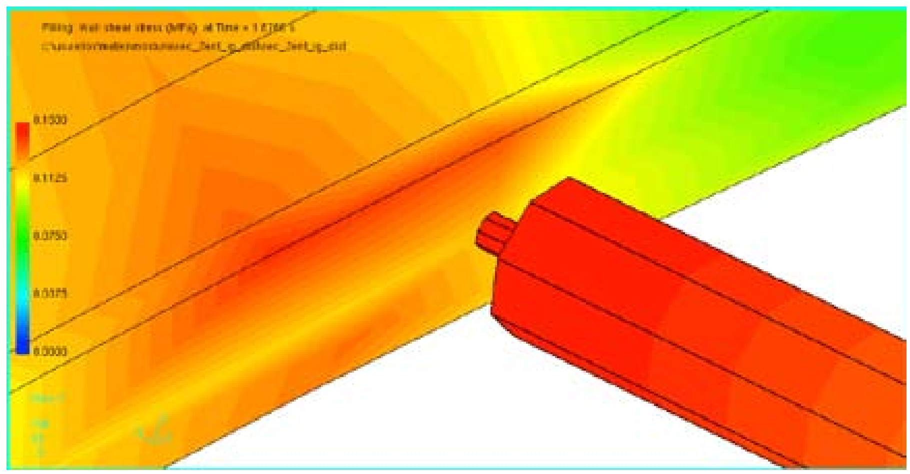

Figure 6: Shear stress evaluated with commercial software just after the gate opening in sequential injection. Value is closer to maximum allowed without polymer degradation.

Conclusions

New injection techniques allow reducing part defects or increasing part functionalities, but designers and mold-makers have to consider the basis of those new process. Sequential injection molding eliminates weld lines, and this fact increases mechanical strength for impact essays and improve aesthetical appearance of final product.

In this paper, authors present some design rules (gate position to optimize injection pressure or how hesitation effect can appear during filling phase) and some considerations on setting adjustment (ram profile will be more complicated than used for conventional process) and, in the same way, some final part properties that engineers should consider during design stage (some asymmetric effects).

Acknowledgements

The authors would like to show their gratitude to the Institute of Polymer Science and Technology of CSIC for its facilities for conducting the tensile tests, in particular Dr. Jesus M ª García Martinez for his support.

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Keywords: sequential injection, mold design.

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An Innovative Rotary Tool Technology For Rapid Heat Cycle Molding

In recent years rapid heat cycle molding (RHCM) has been increasingly used to improve the surface quality of molded plastic products. For a given product the average cycle time of a RHCM process is nearly as long as the one measured in conventional injection molding. In this work an innovative rotary tool technology was developed in order to drastically reduce the cycle time. The equipment consists of a molding cavity heated up to a high temperature, a rotary plate with two cores conditioned at the standard processing temperature and a dummy cavity at cold temperature. Initially the polymer is injected between the hot cavity and the core in the first station. Then the mold is opened and the part is transfered to the second station. The mold is closed and the part is packed and cooled by the cold cavity. In the meantime a new polymer melt is injected in the first cavity. To test the proposed technology, a rotary mold for a large TV frame was realized. The experimental results show that the proposed RHCM technique allows to achieve high temperature injection molding, improve cooling efficiency and drastically reduce molding cycle time without affecting part quality. Experimental tests with different cavity and core temperatures were carried out to optimize the warpage of the TV panel. Numerical simulations were used to analyze the cooling phase and to predict the warpage of the part.

Introduction

Injection molding is widely used to manufacture several different high quality plastic products available today. However, there are still some defects, caused by the process, which need to be removed to further improve the quality of those components, e.g. weld lines, flow marks and poor surface quality. This requirement is especially important if the increasing use of recycled material is taken into account, as even a low percentage of regrinded plastics tend to alter both appearance and processability [1]. The use of secondary processing operations to improve the part's appearance increases the part manufacturing cost and environment impact. Therefore, the employment of rapid heat cycle molding (RHCM) has gained increasing attention because it overcomes the limits of conventional injection molding improving the surface quality and mechanical properties of molded plastic products in only one process step. In RHCM, the mold cavity surface is heated to a high temperature before injection. Then the cavity is kept at high temperature during the filling process and finally the mold is rapidly cooled down to solidify and cool the part before ejection. Due to the high mold temperature, the RHCM technology allows to eliminate the frozen layer and to improve the flowability of the polymer melt. At the same time, rapid cooling can keep the whole cycle time within an acceptable duration.

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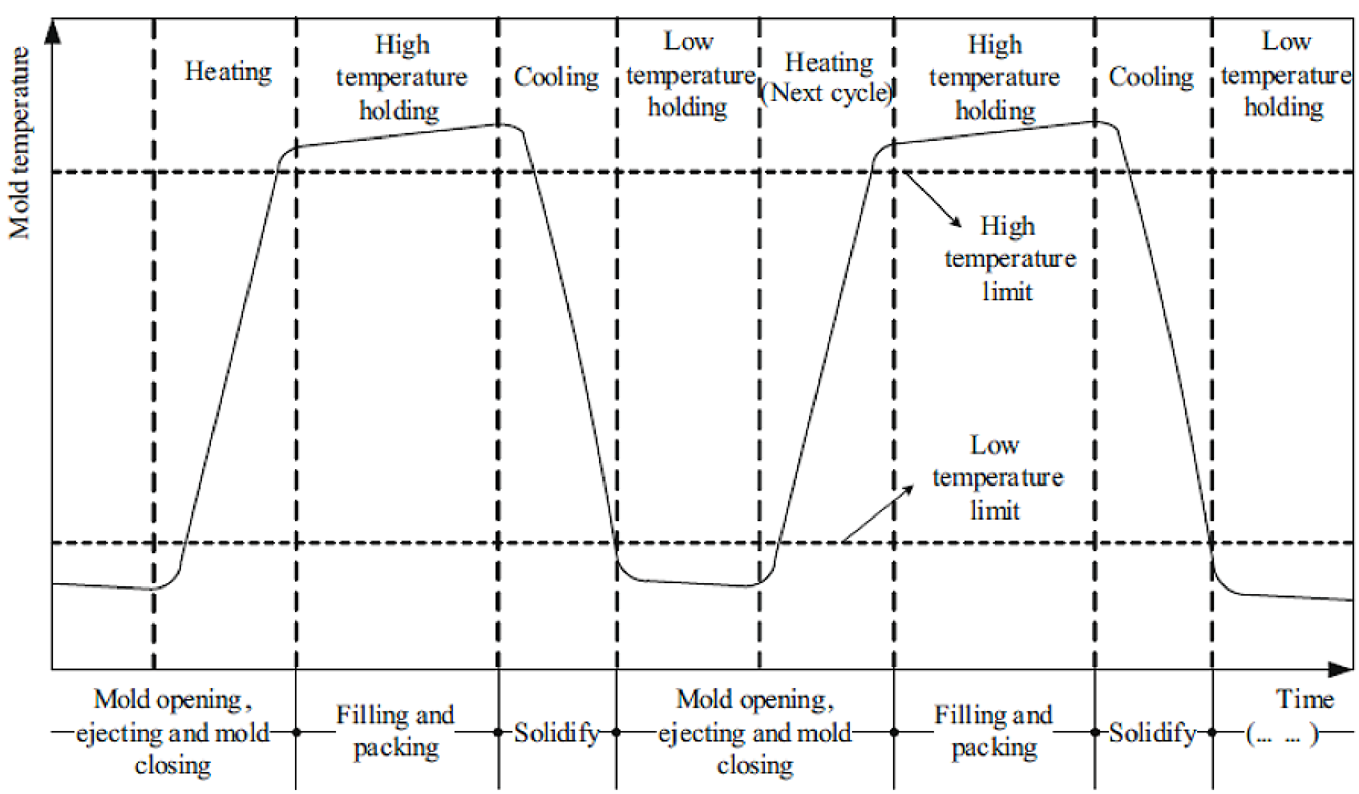
To thermally cycle the mold without increasing the cycle time, an efficient vario-thermal mold temperature control system is required. Jansen and Flaman [2] constructed a multilayer mold to reduce the molecular orientation and residual stresses in injection molded products by rapidly heating the mold cavity surface. Yao and Kim [3] developed a new multilayer mold with two closely matched materials as the heating and the insulation layer, respectively, to reduce the thermal stress at the interface and hence improve the service life of the mold. The low strength of the coating layers and the difficulty in coating the molds with large and geometry complicated cavity surfaces restricted its application in mass production.

The only two mechanisms relevant to mold rapid heating are heat generation and heat conduction. Among all possible heat generation mechanisms, electrical resistive heating is the most widely used mechanism for mold rapid heating. Electrical resistive heating can be accomplished by passing direct or alternating current in cartridge heaters or in a thin electrical conductive layer [4]. Alternatively high-frequency electrical current can be generated at the surface of a large mold mass by skin effects from a high-frequency electromagnetic field. Two useful technical approaches for implementing this skin effect are induction heating [5-7] and proximity heating [3]. The drawback of the induction heating method is that it is necessary to careful design the induction coil to achieve a uniform cavity surface heating. Also, the mold structure corresponding to the proximity heating is very complex and needs to be accurately designed. Heat generation by means of the Peltier effect has also been reported in mold heating, although the thermal rate was quite slow [8]. The aforementioned heating methods do heat the mold efficiently, but still have a lot of shortcomings when applied in mass production. Today, the simplest approach to thermally cycle the mold temperature is by alternating two heating and cooling fluids in the mold [9-11]. These fluids impose a convective heat flux at the fluid–solid interface. The hot fluid may be circulated inside the mold or directly introduced to the mold surface from the mold cavity. Some earlier efforts in mold rapid heating and the earlier version of the variotherm mold heating process were based on this method. Mineral oil has been the most widely used heating medium. The reported heating response in these systems was quite slow, due to the low thermal conductivity and low boiling temperature of oil. To overcome the limited heating temperature of oil, other fluids including hot air and steam can be used [12]. In particular, the steam heating method has recently generated some interest in industry. Although using steam an efficient and uniform heating can be achieved, the reachable mold surface temperature is limited by the properties of the steam and is normally lower than 160°C, which limits its field of application. Additionally, an external boiler is required to generate steam, which will increase the production costs and safety concern related to the transmission of the high pressure steam in the workshop. The whole molding cycle is some seconds longer than that of conventional injection molding and the efficiency of the process is overall quite low.

In the current work a rotary tool technology was developed to overcome the limits of the traditional RHCM. In this new process a molding cavity is kept at a high and constant temperature. Two equal rotary cores are conditioned at standard processing temperature and a dummy cavity with a slightly smaller cavity is kept at a lower temperature. After the injection phase, the mold is opened and the part is moved to the second cavity to perform the packing and cooling phases. To investigate the feasibility of this innovative technology, a prototype mold for a large TV frame was designed and manufactured. Optimal process settings that allow the elimination of superficial defects have been identified. The effect of the electric heating RHCM process on the surface appearance was examined and the warpage of the part was measured. Numerical simulations were carried out in order to evaluated the influence of process parameters on the warpage of the part. The numerical results were compared with experimental data and their accuracy was verified.

Figure 1: Schematic of the mold cycle during the RHCM processes.



RHCM Injection Technology

The RHCM process cycle can be divided into four stages: heating, high temperature holding, cooling and low temperature holding. The principle of the RHCM process is shown in **Figure 1**. Initially the surface of cavity is quickly heated up to the heat distortion temperature of polymer, usually higher than the glass transition temperature of the polymer. Then the polymer melt is injected. The mold temperature is still kept stationary during the filling and packing stages. After these phases, the mold is cooled down by water coolant. When the mold temperature reaches the target value, the plastic part is ejected ending the RHCM cycle. Before the next injection starts, the cavity surface is quickly heated again. The rising and the falling of the mold temperature is operated in a short time frame. The molding cycle is nearly equal to that of conventional injection molding process. Due to the high mold temperature, the viscosity of the polymer melt decreases and skin solidifies slowly allowing a better replication of the cavity surface topography and avoiding the development of weld lines [13-14]. For this reason, the mold cavity is manufactured obtaining a glossy, high quality surface, so that the product surface is bright, smooth, mirror-finished and with no weld marks. Considering the need to increase the efficiency of the whole process, the design of the RHCM molds must be different from that of the conventional injection molds. The layout of the heating and cooling channels, the temperature distribution uniformity on the mold cavity surface and the heating and cooling efficiency are the major concerns in implementing this new molding technology.

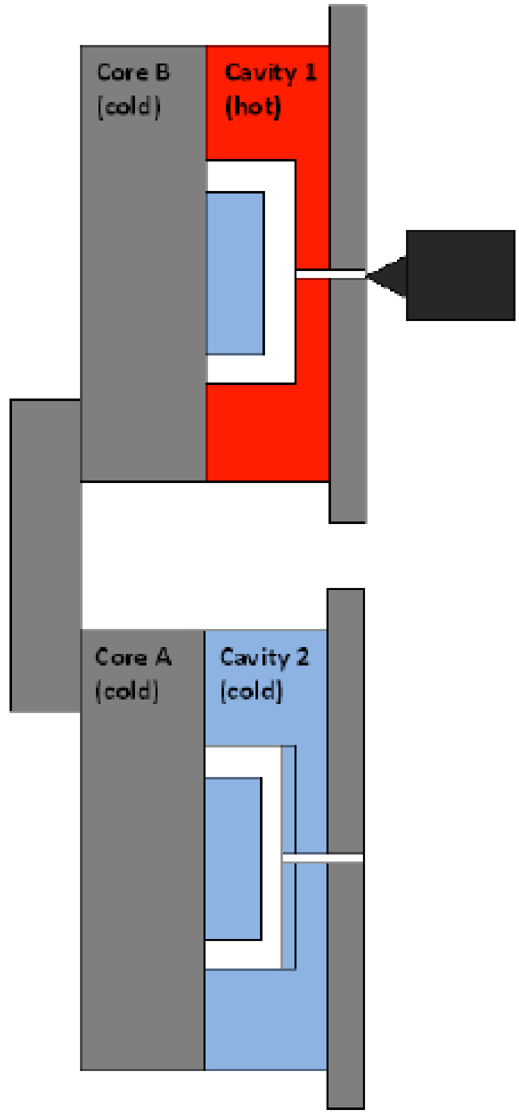


Figure 2: The schematic mold structure.

Process Principle of the RHCM Rotary Tool Technology

Figure 2 describes the schematic structure of the new rotary tool technology. The equipment consists of a molding cavity (1) kept at very high and constant temperature, two rotary cores (A) and (B), having the same geometry, conditioned at the standard processing temperature for the given material and a dummy cavity (2)

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maintained at a lower temperature and having the same shape but reduced dimensions.

Figure 3 shows the different stages of the new RHCM process. Initially the polymer is injected between cavity (1) and core (A). On the cavity side (1) the surface is very hot and plastic melt can flow easily. After a firstholding phase, the mold is opened and the hot part is kept on the rotary core (A). A temperature gradient is present along the part thickness, allowing a partial solidification of the article. Then the table rotates and switches the two cores (A) and (B). The mold is closed and the part on core (A) is formed and cooled on cavity (2). In the meantime a new part can be produced between cavity (1) and core (B). After the injection phase of this latter part, the mold is opened, the previously molded component can be easily demolded and the process cycle restarts from phase 3.

When switching between the first and the second station parallelism and precise alignment are of great importance because they affect the functionality of the system and the part quality. The depth of the second cavity must be reduced compared to the one of the first cavity in order to apply the necessary packing pressure. This technology allows to reduce the complexity of the mold. Conformal cooling channels are not required to quickly cool the part. The possibility of operating with a mold kept at constant temperature reduces thermal stresses and energy consumptions. The main advantage o this solution is the drastic reduction in cycle time. However the thermal cycle can only be applied to the surface of the cavity side.

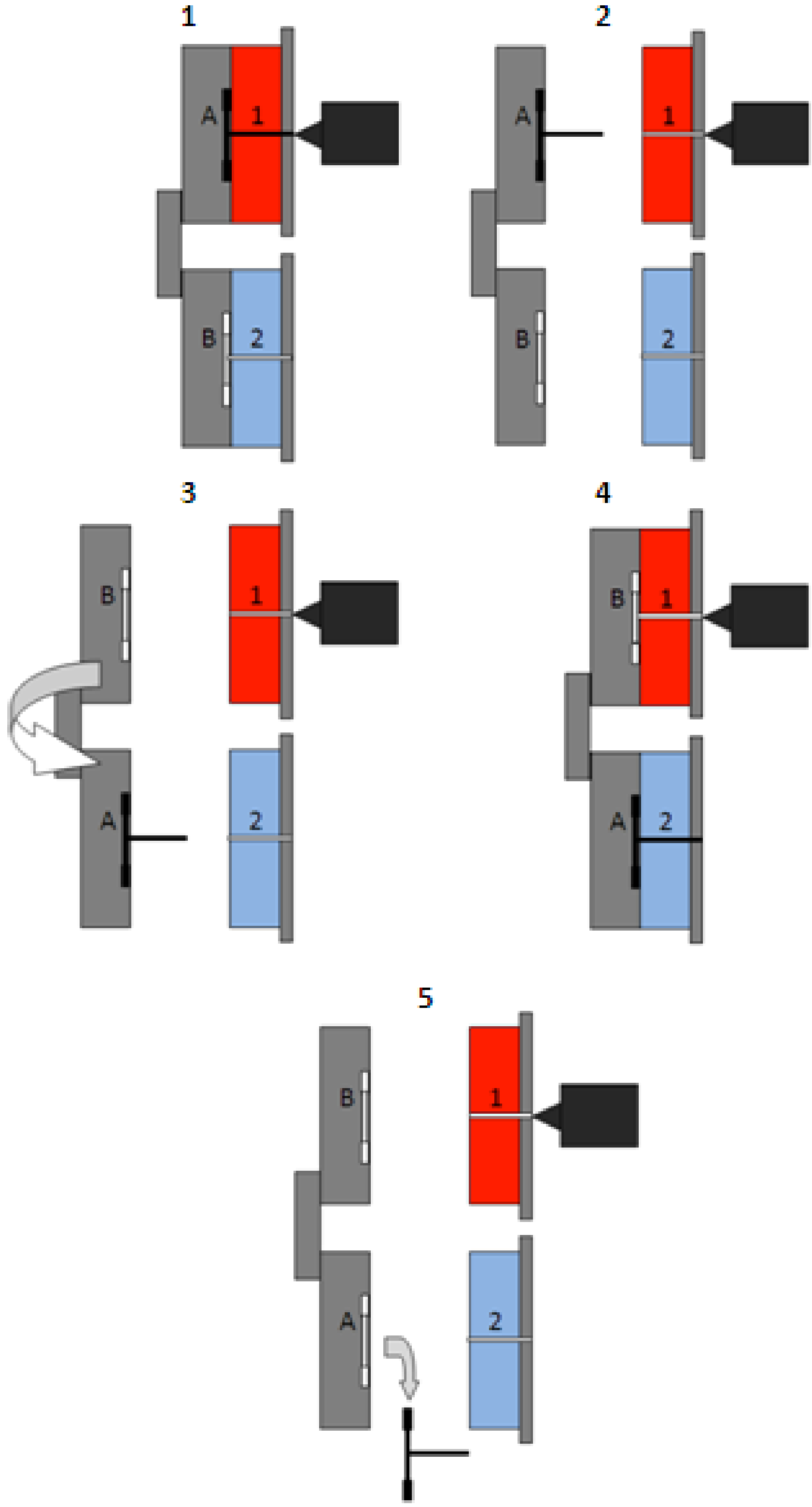

Figure 3: Process stages.

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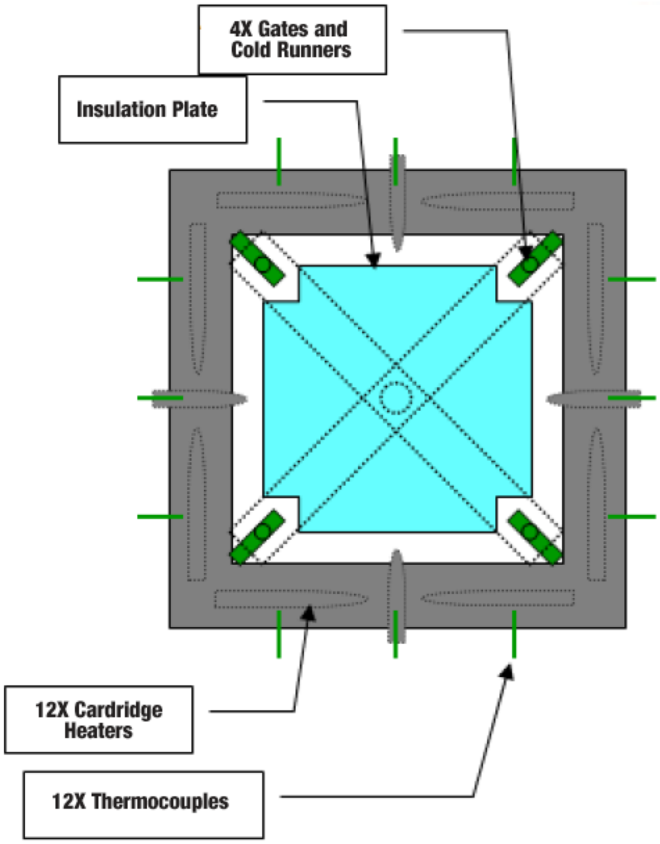
Figure 4 (above): The new RHCM mold with rotary plate.
Figure 5 (right): The schematic structure of the electric heating mold.

Experimental Test

To demonstrated the feasibility of the innovative RHCM technique, an electric-heating mold with two cavity and two rotary cores for a TV frame was manufactured (**Figure 4**). An existing tool that produce a 340mm×340mm×2.5mm single color frame was modified in order to obtain a rotary plate with two cores according this technology. The depth of the second cavity is less of 0.3 mm compared to that of the first cavity, in order to apply the packing pressure. The mold was configured with 4 direct gating nozzles of 3 mm diameter located on the corners of the part and on the aesthetical side of the part (**Figure 5**). Cartridge heaters were used to be able to reach a tool temperature of 160°C or more. Three cartridges were located below each side surface of the cavity at a distance of 15 mm from the cavity with one positioned exactly at the center to control the knit line temperature. Four thermocouples were placed at 5 mm from the



cavity and were used to control the temperature evolution during the process. The experimental campaign was conducted on a 15000 kN injection molding machine. The plastic material used in this study was PC/ABS supplied by Bayer MaterialScience. Its glass transition temperature (T_g) is 135°C. The melt density, thermal conductivity, and specific heat at about 240°C are respectvively 0.98 g/cm^3, 0.219 W/(m °C), and 2133 J/(kg °C). The melt viscosity was accurately measured as a function of shear rate and temperature under process conditions by using an in-line rheometer [15]. The temperature of the cavity surface before melt injection was set at 145°C. The injection speed and the melt temperature were set to the highest limits of the molding window in order to decrease the viscosity of the polymer during the injection phase. During the experimental tests some drawbacks were observed (**Figure 6**):

- Due to the high temperature, the part tended to stick on the hot cavity on the first station during the mold opening.
- Scratches and knit lines occurred on the aesthetical surface during opening on the first station or closing on the second station.
- Deformations and wrinkles occurred when closing on the second station.
- Gate marks appeared after cold pressing on the second station.

Figure 6: Superficial defects.

By fine tuning the process parameters, the weld marks on the panel surface were eliminated completely and its surface became bright and smooth.

In this process the injected melt partially solidifies inside the first cavity. Then the plastic part is ejected and moved to the second cavity for complete cooling. If the mold is opened too early, the plastic material can escape the cavity and does not completely fill the second cavity. On the other hand, if the part remains for too long in the first station, the cycle time increases. So the cooling time of the injected part in the first cavity greatly affects the aesthetic quality of part and the process efficiency. In order to accurately estimate the cooling time in the first station, it is necessary to define the ejection conditions. Numerous experimental tests allowed the molder to determine cycle time of 17.71 s, as the minimum time possible that permits to avoid defects and to meet part quality specifics. Experimental tests were carried out varying the ejection time from the first station until the molded part met the quality specifics.

Another important problem in thin walled parts is warpage. In this process the elevated differences in temperature between the different sides of the two cavities increased the part distortion. Two different process parameters were varied in order to evaluate their influence on warpage: cavity (2) and core temperatures.

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Each parameter was varied between two levels with 5 replications. As indicated in **Table 2**, the optimal parameters set, that allows to minimize the frame warpage, requires high core temperature and low secondcavity temperature.

The average molding cycle time of traditional RHCM for a TV frame of the same size is about 60 s. With this technology the cycle time is reduced to 27.4 s. In other words, the cycle time of the new RHCM technology is cut by a half of what is achievable with the traditional method, gaining a consistent reduction in energy consumption. Therefore, the new molding system realized in this study can heat and cool the injected part rapidly to meet the requirements of the RHCM process and eliminate the frame surface defects decreasing the molding cycle time.

Table 2: Comparison between experimental and numeric results

T_{cavity}	T_{core}	Warpage [mm] Experiments	Warpage [mm] Simulation
30	50	20.3	18.7
30	80	12.4	13.3
50	50	22.3	21.7
50	80	15.9	16.3

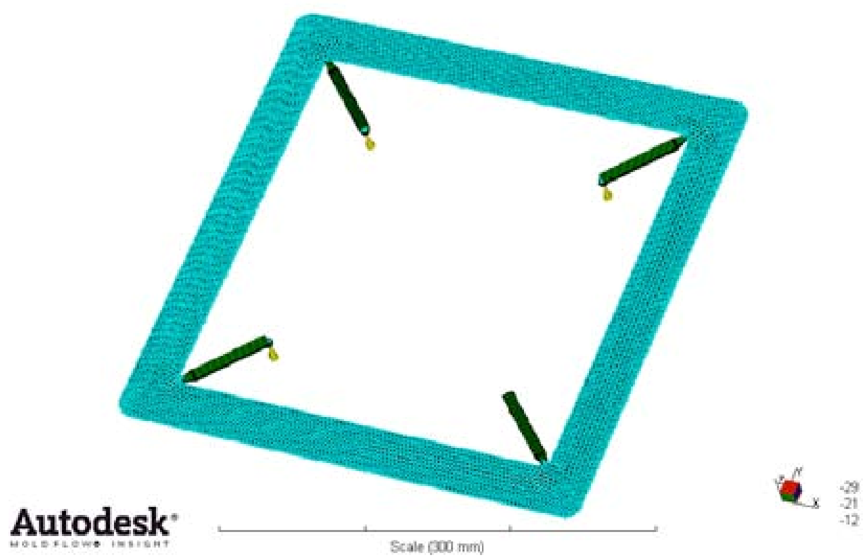

Figure 7: Finite element mesh of the model.

Finite Element Simulation

The ability of commercial software applications in simulating this new process was investigated. The numerical analyses were carried out using Autodesk Moldflow Insight 2010. A Dual Domain mesh type was used. The model was discretized into 22430 elements (**Figure 7**). The rheological behavior was described using the Cross-WLF viscosity model:

$$\eta = \frac{\eta_0}{1+\left(\frac{\eta_0 \dot{\gamma}}{\tau^*}\right)^{1-n}} \qquad (1)$$

$$\eta_0 = D_1 \exp\left[\frac{-A_1(T-T^*)}{A_2+(T-T^*)}\right] \qquad (2)$$

where η is the shear viscosity, $\dot{\gamma}$ is the shear rate, T is the temperature, T^* a reference temperature (K), n, τ^*, D^1, A^1 and A^2 are data-fitted coefficients. The model constants for the resins are provided in **Table 1**. A 3D

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fully transient approach is proposed to simulate the injection molding process with cooling phase. Moldflow allows to assign different temperatures to the surfaces of the part. The core and cavity temperatures were set according to the experimental test. Two different process parameters, cavity (2) and core temperatures, were varied in order to determine their influence on the part warpage.

Four different warpage data were calculated:

(a) Total warpage.

(b) Warpage along X-axis.

(c) Warpage along Y-axis.

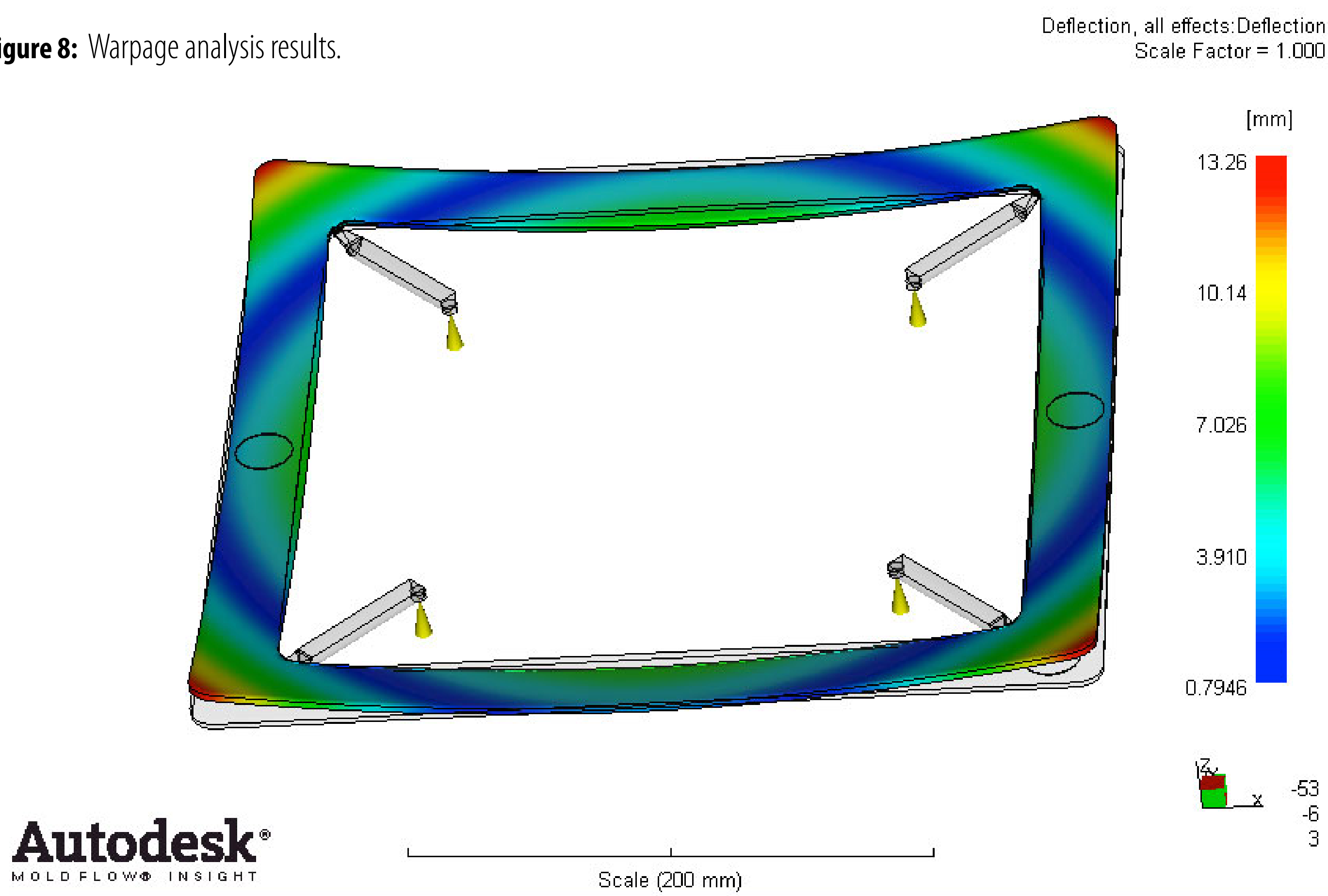
(d) Warpage along Z-axis.

Table 1: Shear viscosity model parameters.

	PC/ABS
n	0.4631
τ^*	147144 [Pa*s]
D^1	2.01287e=009 [Pa*s]
T^*	417.15 [K]
A^1	20.646
A^2	51.6 [K]

Total warpage values were used as warpage values in this study and compared to the experimental data. Total warpage values obtained from simulations were very close to those ones measured experimentally (**Figure 8**). These simulations also allowed to calculate a minimum value of 0.264 for the percentage of frozen layer

Figure 8: Warpage analysis results.



at the ejection time from the first cavity, that was determined from the experimental tests. This value can be assumed as the ejection condition when the part is stiff enough to sustain the ejection.

Conclusion

An innovative RHCM technology with a rotary plate and two cavities was developed. The new mold structure allows to drastically reduce the cycle time compared to that of the conventional RHCM process without compromising the aesthetic quality of the plastic injection product. The possibility to maintain the first hot cavity at a constant temperature eliminates the need of the heating stage in the cycle. Also no sophisticated heating and cooling systems or conditioning fluids are required. A prototype mold for a large TV frame was designed and manufactured.

The cooling stage begins in the first station and ends in the second one. The experimental tests have allowed to determine the minimum ejection time in which the injected part have sufficient stiffness to be transferred into the second station. The average molding cycle time of the traditional RHCM for a TV frame having the same size is about 70 s. In other words, the RHCM with electric heating has almost the same molding efficiency of the conventional injection molding. With this new RHCM technology the molding cycle time was about 27.4 s. The proposed technology allows to reduce the cycle time by 50% with a significant improvement in process efficiency. During the experimental tests some drawbacks have been observed, as sticking of the melt part on the hot cavity surface, scratches, marks and deformations. But these problems have been solved with an optimal parameters setting. Core and cavity temperatures have been varied in order to evaluated their influence on the panel warpage. The optimal process parameters that allows warpage reduction have been identified.

Autodesk Moldflow Insight 2010 was used to simulate this new process by assigning different temperatures to the part surfaces. The process parameters were varied according to the design of experiment and the warpage values calculated by numerical simulations were compared with the experimental results. The agreement between simulations and experiments demonstrates the capability of the proposed numerical model. Furthermore, the simulations allowed to determine the percentage of frozen layer at the ejection time from the first cavity. This value has been assumed as the ejection condition for opening the mold in the first phase.

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Key Words: rapid heat cycle molding, rotary tool, numerical simulation, TV frame, high gloss, no weld mark.

IMD Board of Directors Meeting

February 3, 2012 –Orlando, FL

Submitted by Hoa Pham, Secretary

Welcome

Acting Chair Susan Montgomery called the meeting to order at 9:00 am ET, and welcomed all attendees. She presented David Kusuma and David Okonski as invited guests. She also thanked David Kusuma for hosting this meeting at the Tupperware facility.

Mr. Billy Eubanks, Vice President of Tupperware TPS Products & Global Procurement welcomed the Board.

Kishor Mehta introduced David Kusuma from Tupperware, and Peter Grelle introduced David Okonski from General Motors. The Board welcomed both invitees.

Susan appointed David Kusuma and David Okonski to the Board for one year, with term ending at ANTEC 2013.

IMD Board of Directors Meeting Continued

Roll Call

Present in person were:

Susan Montgomery (Chair-Elect), Jim Wenskus; Peter Grelle; Hoa Pham; Brad Johnson; Pat Gorton; Lee Filbert; Kishor Mehta; Tom Turng; Raymond McKee; Jim Peret (Emeritus); David Kusuma (Guest); David Okonski (Guest).

Present via teleconference were:

Larry Schmidt; Nick Fountas; Adam Kramschuster; Jack Dispenza; Erik Foltz; Michael Uhrain, and Tricia McKnight (SPE Leadership Liaison).

Absent were:

Jeremy Dworshak (excused)

This constituted quorum.

Approval of October 31, 2011 Meeting Minutes

The meeting minutes of October 31, 2011 were presented.

<u>Motion:</u> Hoa Pham moved that the October 31, 2011 meeting minutes be approved, as written and distributed. Peter seconded and the motion carried.

Financial Report – Jim Wenskus, Treasurer

For the 2011-2012 fiscal year, financial figures of the quarter from July 1, 2011 through December 31, 2011 were reviewed. Newsletter sponsorships were discussed. David Kusuma expressed interest in working with the Board to explore corporate sponsorships. In discussing about the IMD reception, Jack Dispenza requested assistance in getting sponsors, and Erik Foltz agreed to assist.

The proposal for 2012 – 2013 budget was reviewed. Susan mentioned that Len Czuba had contacted her to ask for student sponsorships. The IMD had been a silver level sponsor. Susan asked the Board to consider either maintaining this level of sponsorship or increase it to the gold level. Discussions ensued on the impact of this move on the budget.

<u>Motion</u>: Tom Turng moved to increase the student sponsorship from silver level to gold level. The motion was seconded, and carried.

The budget line item for student sponsorship was adjusted accordingly.

Councilor Report – Brad Johnson, Councilor

The last council meeting was held on November 12, 2011 in Barcelona, Spain. The 2012 budget was approved. With the Society's financial status being healthier than last year's, the budget for rebates was increased. The Council has been working on a bylaws change to address the rules for activating some divisions and SIGs, and for placing student chapters on probation.

Compared to last year, membership increased modestly to more than 15,000. Regarding conferences, the Eurotec held in November 2011 attracted 200 papers. The upcoming ANTEC 2012 will be colocating with NPE in Orlando, FL.

The Society leadership election was conducted. A new CEO for the SPE was recently announced. The next

IMD Board of Directors Meeting Continued

Council meeting was scheduled for the end of February and would be virtual.

Communications Committee Report – Adam Kramschuster

Adam presented Heidi's quote to upload and maintain the IMD website. Nick Fountas mentioned that the IMD website can be hosted on the same platform as his company's. He would work with Adam on this item.

Adam announced that he had created a Facebook page for the IMD, which would be a complementary avenue for the Division to reach out to members as well as attract potential new members. As a start, Adam requested Board members to provide him with photos that could be posted.

Paid sponsorship for 2012 was reviewed, and Susan volunteered to help with getting additional sponsors.

Heidi published the Fall newsletter, and concluded her contract. Although she has started to solicit articles for the Winter issue, the Board had to decide whether or not to renew her contract which would include responsibilities of both publishing and obtaining sponsorships. Discussions ensued on the number of new sponsorships that Heidi brought in.

Motion: Kishor moved to renew the contract with Heidi for one more year. Raymond McKee seconded it, and the motion carried.

The SPE and Autodesk have been organizing an event that included participation of members of the IMD Board. Adam raised the question of linking the IMD to this event. Erik and Brad, who would be participating in this conference, agreed to coordinate to include affiliation with the IMD.

Action Item1: *Nick and Adam will work on hosting the IMD website.*

Action Item 2: *Nick will work with Jim and Heidi on new contract.*

Action Item 3: *Brad and Erik will coordinate to include the IMD in the Autodesk event.*

Pinnacle Award – Susan Montgomery

Susan thanked the Board for their input on activities that were used to meet the criteria of the award. The IMD applied for the Gold Award. Tricia indicated that she had received the application and all documents.

Technical Director Report – Peter Grelle

Peter presented the trends in ANTEC papers from 1992 to present. After a decreasing trend over the last few years, a modest upward trend was seen for 2011. The total number of papers from the IMD program fluctuates between 60 and 120, with a slight recovery in 2012. The trend from previous years shows that in an NPE year, such as 2009 and 2012, the number of papers from industry increases. Overall, a high percentage of papers is still from academia. The quality of papers, measured by the APQIndex, also improves in 2012.

The TOPCON schedule includes the conference at Penn State, Erie in 2013. Peter was still not able to connect with the Upper Midwest section for the medical conference.

Other ideas to expand the IMD's TOPCON activities were discussed.

Action Item 1: *Peter will explore joint opportunities with the Detroit Section or Automotive Division.*

Action Item 2: *Tom Turng will explore sponsorship opportunities for the IMD when he travels to Asia.*

ANTEC 2012 Report – Erik Foltz, TPC

Erik gave an update on the IMD technical program for ANTEC 2012. The paper review was held on November 3, 2011 in Madison, WI, and reviewers were Erik, Peter, Susan and Pat. There were 66 podium papers, 4

IMD Board of Directors Meeting Continued

interactive and 7 commercial papers. Three keynote speakers were engaged. Erik called for volunteers to moderate the sessions.

The Board discussed awards for student papers. Brad and Adam noted that the early submission deadline made it difficult for undergraduate students to submit papers. Tricia suggested to bring this idea to the Students Activities Committee for advocacy. Further discussions were made on types of awards.

Erik proposed a plan to award at the IMD reception.

Motion: Brad moved that the Board award only plaques this year. Erik seconded and the motion carried.

Motion: Brad moved that the Board table the awards discussions to the next meeting. Lee seconded, and the motion carried.

Engineer Of The Year Award – Kishor Mehta

Kishor reported that no award would be presented this year.

SPE Update – Tricia McKnight, SPE Leadership Liaison

Tricia mentioned that the Society had hired a new CEO, who would be based in Belgium. At the end of 2011, membership showed a modest positive growth. The review for Pinnacle Award was still in progress. Looking ahead, ANTEC 2013 will be located in Cincinnati, from April 21 through April 25.

Education Committee – Pat Gorton, Chair

Pat presented information on molder certification program. The history of this program at SPE showed poor industry response, and was closed in 1999 due to financial resources.

Other existing programs include Global Standards for Plastics Certification offered by MAPP (Manufacturing Association of Plastics Processors), Promolder offered by Paulson School of Training,. Specialized training has been covered by John Bozelli, ARoutis Associates, and various resources on the SPE website.

Pat recommended that the Board reach out to MAPP to determine if synergy could exist between their organization and the IMD to offer the certification program. The Board could continue to encourage members to use existing resources available through membership.

Action Item: *Susan will contact MAPP and invite them to present to the Board at a future meeting.*

Nomination Committee – Hoa Pham, Chair

Hoa presented the nominees for the 2012 Board Officers: Erik Foltz, Chair-Elect; Jim Wenskus, Treasurer; Hoa Pham, Secretary; Peter Grelle, Technical Director.

Motion: Hoa moved that the Board approve the nominees. The motion was seconded and it carried.

Hoa presented nominees for the general election to a three-year term on the Board: Lee Filbert, Raymond McKee, Jeremy Dworshak, Adam Kramschuster, and Pat Gorton

Motion: Hoa moved to recommend that the Board approve the nomination of the candidates for the 2012 Ballot as presented. The motion was seconded and it carried.

Hoa called for candidates for TPC of ANTEC 2015. Raymond volunteered.

Action Item: *Hoa will coordinate the general election of nominees to the Board.*

IMD Board of Directors Meeting Continued

Membership Committee – Nick Fountas, Chair

Nick gave a brief update on the demographics of the IMD membership: 78% US, 17% Asia, 5% Europe and 1% Middle East. With this year's ANTEC colocating with NPE, Nick suggested that additional IMD brochures be printed and distributed at the show. Susan requested some brochures to distribute at the upcoming medical device conference that she would be attending in March.

Action Item: *Nick and Tom will provide Susan with the remaining brochures.*

Fellows & HSM Committee – Larry Schmidt, Chair

Motion: Larry moved that the Board nominate Mal Murthy for HSM in 2013. Pete seconded and the motion carried.

Larry asked the Board to recommend Fellows and HSM candidates for 2013 and beyond.

Old Business

None discussed.

New Business

Susan reminded the Board that the next Board meeting would be at 9:00 am on Sunday April 1, 2012 in Orlando, FL. The next teleconference will be in the Fall.

Adjournment

Motion: Peter Grelle made a motion to adjourn the meeting. Jim Wenskus seconded and the motion carried.
The meeting was adjourned at 2:37pm ET.
Submitted by Hoa Pham, February 21, 2012

IMD Leadership

DIVISION OFFICERS

IMD Acting Chair
Chair-Elect
Susan E. Montgomery
Priamus System Technologies
s.montgomery@priamus.com

Technical Director
Peter Grelle
Plastics Fundamentals Group, LLC
pfgrp@aol.com

Treasurer
Jim Wenskus
wenskus1@frontier.com

Secretary
Assistant Treasurer
Nominations Committee, Chair
Hoa Pham
Avery Dennison
hp0802@live.com

Past Chair 2011 - 2012
Lee Filbert, IQMS
lfilbert@iqms.com

Councilor, 2011 - 2014
Brad Johnson
Penn State Erie
bgj1@psu.edu

BOARD OF DIRECTORS

TPC ANTEC 2012
Erik Foltz
The Madison Group
erik@madisongroup.com

TPC ANTEC 2013
Pat Gorton
Energizer
pgorton@energizer.com

Communications Committee Chair
TPC ANTEC 2014
Adam Kramschuster
University of Wisconsin-Stout
kramschustera@uwstout.edu

TPC ANTEC 2015
Raymond W. McKee
Berry Plastics
raymond.mckee@berryplastics.com

Membership Chair
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JLI-Boston
fountas@jli-boston.com

Education Committee Chair
Reception Committee Chair
Jack Dispenza
Ideal Jacobs
jackdispenza@gmail.com

HSM and Fellows Committee Chair
Historian
Larry Schmidt
LR Schmidt Associates
schmidtlra@aol.com

Engineer-Of-The-Year Award Chair
Kishor Mehta
Plascon Associates, Inc
Ksmehta100@gmail.com

Lih-Sheng (Tom) Turng
Univ. of Wisconsin - Madison
turng@engr.wisc.edu

Michael C. Uhrain IV
Sumitomo
michael.uhrain@dpg.com

The IMD Welcomes 293 New Members From Around the World

Stan Agee
Miguel Aguirre
Eric Aldstadt
Jeremy E.J. Alexander
John Alger III
Christopher Alibozek
Mandar Amrute
D. Anandamurali
Bistra Andersen
Niles Anderson
Craig Andrews
Russ Andrews
B. Bharati Annamalai
Steve Armbruster
Teresa Arthur
S. Arunprasath
Cyril Baidak
Joe Baiz
Tyler Baran
Carol Barnes
Diamond Amber Bartlett
Bret Baumgarten
Donald Berrill
Bikram Beura
A. Narasimha Bharathi
Nilesh Bhasvar
Kapell Kumar Birla
M. R. Biswal
Peter Bloss
Chris Bodine
Louis Bowler
Kevin Brady
Toby Bral
Scott Brewer
Brent Brown
Timothy Bryan
Edward Buckwald
Richard Byrd
Deepak C.
Carl Carlson
Don Cartwright
Kevin Casey
Kendall Chadwick
Rajat Chakraborty
Dane Chang
James Chapman
Amador Charad
Kristin Charlton
Cyril Chevillard
Teckli Chia
Sreenivas C. J.
Marcus Clarke
Bennett Cohen
Travis Cole
Scott Cooley
Raymond Coombs
Charles Cooper
Justin Courter
Markus Cremer
Claude Cybulski
Joseph DeConinck
Jimmy Deese
Mario Del Real
John Deruntz
Dilip Dhobale
Sandrine Dumarquez
Dawn Duncan
Oktay Ekinci
Miron Eydman
Mark Field
Andrew Fleming
Michael Formella
Raindra Fotedar
Kenny Freitag
Atul Gakhar
Richard Gallagher
Vincent Gallo
Roy Galman
Angel Lozano Garcia
Ludovic Gardet
Larry Wayne Geist
Ethan George
Tracy Geschke
Alicia Gibson
Kyle Gibson
James Gingrich
Stan Glover
Leslie Goff
P. R. S. Gopalan
Daniel Gorman
George Graham
Reid Grahame
Randy Guertin
Vilas Gupte
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Antonio Marcucci
Ravindra Marudkar
Adesh Mathur
Andrew May
Joe McCaleb
Kenneth McCord
Patrick McDonough
David McDowell
Joseph Mechery
Vivek Mehta
Tom Mendel
Jerry Mercer

IMD New Members Continued

Thomas Mielcarek
Johnathan Miller
Diane Mixson
John Moczalla
Khatera Mohd-Habib
Carlos Molinuevo
Richard Moller
Ricardo Montes
Bala Murali
Jacob Murphy
Luke Murphy
GSVL Narayana Murthy
K. Nagaraj
B. K. Nagasayee
Matthew Nagy
Aditya Narayanan
K. Narayanan
Sam Nashed
David Brian Naughton
Mark Allen Newman
Larry Nitch
David Okonski
Obelle Ollor
Edward Owen
Mark Paddock
M. Padmanabh
Rajesh Panchal
Lu Papi
K. V. Parthiban
Andrew Paye
Vasant Pednekar
Ricardo Pena
R. Prabhu
Fred Pratt
Rohan Primrose
Bill Psevdoikonomou
Sandeep Puri
William Quinn
Hansraj R.
Srivathsan R.
Walter Robb Railey
N. K. Ramaswamy
P. Ramesh
Steve Ramos
Christopher Reeves
William Renick
Sam Richardson
Glen Riley
Paul Robinson
Milan Roldan
Thomas Rooney
Timothy Rourke
William Rousseau
Al Rouwenhorst
Kaysie Rytlewski
Rickard Kent Bo Sandberg
Sofie Sannen
M. S. Saravanan
Frances Scharnhorst
John Schmidt
Arul Selvam
Acharya Sen
Karl Seven
Nainesh Shah
Pulkit Shah
Rakesh Shah
Siva Shankaran N.
Manish Sharma
Vinod Sharma
Sandeep Shinde
Ebi Shokri
Ankit Shroff
Joe Simmons
Ankita Singh
Kuldeep Singh
Michael Skapura
Matt Smallwood
Norman Snitchler
Todd Sousley
Paul Sremcich
Girish Srinivasan
R. Srinivasan
Veeraraghavan Srinivasan
Debbie Stueber
John Sudak
Mark Summer
Steven Sutherland
Leon Suttles
Subramaniam T.
Peter Tackx
Jonathan Tan
Stephen Taylor
Keith Teague
Harshit Tejani
Aster Teo
Chad Terpstra
Rajesh Theravalappil
Deepak Thuse
David Tonkiss
Pankaj Totla
Christian Trejo
Gregory Tremblay
Linda Tremblay
Scott Tripple
Hakan Tunca
Luc Uytterhaeghe
Dirk Vander Noot
Paul Vanevery
M. S. Venkataramani
C. R. Venkateswaran
Maricela Ventura
Christopher Verdigets
Rogelio Villamizar
Sonia Villamizar
Wayne Wagener
Sachin Wagh
Sunil Waghralkar
Paul Walker
Tim Watt
Peter Weisel
Christian Wenk
Victor Wenzel
Russell Wieser
Philippe Antoine Wilson
Xiaoka Xiang
Emily Yu
G. Yuvaraj
A. Zainulabedin

The IMD Also Welcomes Companies From 23 Countries

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Belgium
Brazil
Canada
Chile
Colombia
Czech Republic
Denmark
France
Germany
Greece
India
Japan
Mexico
Netherlands
Poland
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South Korea
Spain
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Turkey
United Kingdom
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IMD New Members Continued

Representing More Than 227 Organizations, Including:

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3M Co.
4 Front Manufacturing
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ACOS Ltd.
Advanced Graphic Systems
AFI Systems LLC
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Coperion Ideal Pvt. Ltd.
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Imerys

IMD New Members Continued

Indelpro Sa De Cv
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Qenos
Reliance Industries Ltd
Renault Nissan Technology & Business Centre India
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Sac Plastics Inc.
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Star Maid
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Vari-Tek Co.
Vision Technical Molding LLC
Vistakon - Johnson & Johnson
WG Strohwig Tool & Die
Wacker Chemical Corp.
Wagener & Associates Inc.
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Washington Penn Plastic Co.
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Westmoreland Plastics Co.
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Membership Application

Society of Plastics Engineers Membership Application

13 Church Hill Road, Newtown, CT 06470 USA
Tel: +1 203-775-0471 Fax: +1 203-775-8490
membership@4spe.org www.4spe.org

European Member Bureau
Tel: +44 7500 829007
speeurope@4spe.org www.speeurope.org

Applicant Information

Name:
first last mi

Company Name and Business Address (or College):
company/college:
job title:
address:
address:
city: **state:**
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Gender: ❑ Male ❑ Female

Birth Date: (mm/dd/yyyy)

Demographics

Job Function *(choose only one)*
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- ❑ Engineer
- ❑ General Management
- ❑ Manufacturing
- ❑ Marketing/Sales
- ❑ Other
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- ❑ Quality Control
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- ❑ Self-Employed
- ❑ Student
- ❑ Tech Support

Materials *(choose all that apply)*
- ❑ Composites
- ❑ Film
- ❑ General Interest
- ❑ Nylon
- ❑ PET
- ❑ Foam/Thermoplastics
- ❑ Polyolefins
- ❑ Polystyrene
- ❑ TPEs
- ❑ Thermoset
- ❑ Vinyls
- ❑ No Interest

Process *(choose all that apply)*
- ❑ Blow Molding
- ❑ Compression
- ❑ Compounding
- ❑ Engineering Properties
- ❑ Extrusion
- ❑ Fabrication
- ❑ Foam
- ❑ Injection Molding
- ❑ Mold Making
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- ❑ Thermoforming
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card number

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signature date

recommended by member (optional) Id #

WWW

Publisher Note | Sponsors

Message from the Publisher

Thank you for taking the time to read this edition. I hope you found this edition helpful with its tips on business, hot runner issues, mold maintenance and more.

If you haven't already done so, register for ANTEC 2012 and NPE 2012 shows. TheIMD reception at ANTEC is on Tuesday, April 3, 2012 from 5-7 PM in meeting room 320AB. This is a great opportunity for you to network. All information can be found at http://www.npe.org/Attend/content.cfm?itemnumber=7349&navItemNumber=4380

Have any tips of the trade for your fellow members? If any of you have any tips you wish to share, please pass them along. We are always looking for input from our members on any successes or in getting jobs done. Remember to send in any questions on hot runners, mold maintence, injection molding and even business issues. Our experts may be able to help!

Heidi Jensen
PublisherIMDNewsletter@gmail.com

We would like to thank the following sponsors for this edition of Molding Views

We would also like to thank the authors who provided articles for this month's issue.

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