Summer 2016 | No. 102

MOLDING VIEWS

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

In This Issue:

Letter from the Chair **1**
Industry Events **3**
Webinar Listings **4**
Ask the Expert: Injection Molding **6**
SPE Fellowship: Fellow of the Society **8**

This Month's Features:

Venting Basics **13**
| *Dallas Cada*

Should You Use Re-Grind? **17**
| *Eric R. Larson*

IMD Best Paper:
Thermal Analysis of Conventional and Rapid Tooling for Injection Molding **20**
| *Gabriel A. Mendible, Jack Rulander, Stephen P. Johnson*

Achieve Plastic Part Dimension Accuracy Through 3D Volume Shrinkage Compensation Method **30**
| *Nita Tseng*

IMD Board Minutes **33**

IMD Leadership **38**

IMD New Members **39**

Membership Application **40**

Publisher's Message/Sponsors **41**

Chair's Message

Summer is upon us and we have had a lot of activity over the past few months. In May, ANTEC was held in Indianapolis. At this event, the IMD held our business meeting on Sunday and our annual Networking Reception on Tuesday night. I would like to take this time thank all of our sponsors for allowing us to put on this event. We had a great turn out for the event and were able to recognize a lot of individuals for their contribution to the industry and to the society. In June, we sponsored the Innovation and Emerging Plastics Technology Conference at Penn State Erie.

Chair's Message Continued

I have been a member of the Injection Molding Division Board since 2008 and I am more excited than ever at the direction of the Injection Molding Division. We have been able to do things that provide more value and outreach. We are now sponsoring Student Design projects at Universities and funding early education outreach. The support of you, our sponsors, and the hard work of the board members allows us to be able to execute these programs. As we move forward, I see great things in our future.

Best regards to all,

Ray McKee
2016-2017 IMD Chair
Sonoco
Raymond.Mckee@sonoco.com

Industry Events Calendar

Click the show links for more information on these events!

AUGUST 2016

AUGUST 11
ATI Industrial AUtomation Technology Fair
Orion Township, Michican

AUGUST18-19
The North-East TopCon, Trends & Innovation
Quebec City, Canada

SEPTEMBER 2016

SEPTEMBER 7-9
Automotive Composites Conference & Exhibition
Novi, Michigan

This event is designed to educate and update automotive design and production engineers, sales personnel, and management from transportation OEMs and Tier suppliers about the benefits and expanding importance of thermoset and thermoplastic composites in passenger vehicles, light trucks, and other ground transportation applications.

SEPTEMBER 12-17
IMTS 2016
Chicago, IL

The International Manufacturing Technology Show is one of the largest industrial trade shows in the world, featuring more than 2,000 exhibiting companies and 114,147 registrants. The event is held every two years in September at McCormick Place, Chicago.

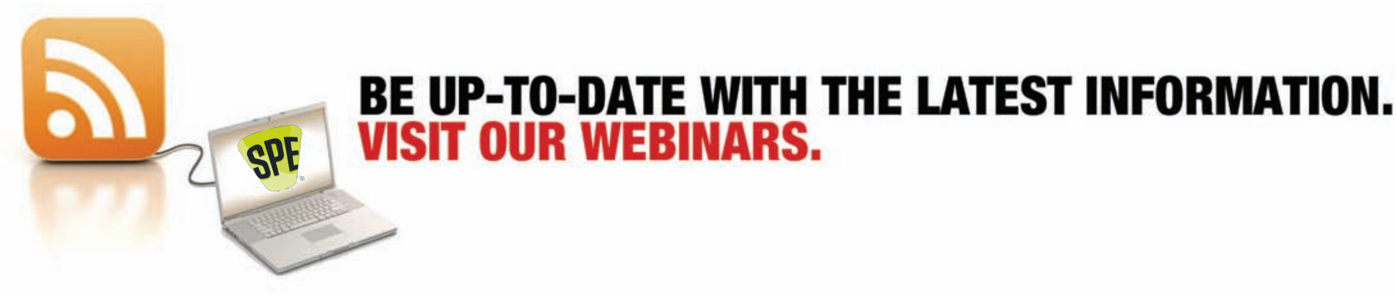
SEPTEMBER 12-15
Color and Appearance Division Conference
Seattle, WA
The 54th Annual Society of Plastics Engineers Color and Appearance Division RETEC® is quickly approaching. This year's conference will be held near Jacksonville, FL. This year's theme is "Driving Color Into The Future". CAD RETEC® is the world's largest technical conference in North America that is specifically dedicated to the color and appearance of plastics.

SEPTEMBER 13-14
Additive Manufacturing Conference
Chicago, IL
The focus of the Additive Manufacturing Conference is on industrial applications of additive technologies for making functional components and end-use production parts. It will cover the processes, applications and materials to give you practical knowledge on how to implement AM in your facility.

SEPTEMBER 14-15
Midwest Design - 2 Part Show
St. Charles, MO

SEPTEMBER 12-15
SPE Foams 2016
Seattle, WA

Webinars



Using the Power of DOE to Design Process and Part Improvement

Moldflow is the leader in simulation technologies for Plastics manufacturing. But with tightening expectations on part quality, evaluating critical variables of the processes for influence over design and manufacturability are more important today than ever before. Using Moldflow's Process Optimization and DOE, simulation experts now have the ability to determine critical variables of the process and their influence over specific design criteria, and with the advanced controls part influences can be visualized in real-time. Now with the use of Moldflow, simulation experts are not just driving design influence but also design understanding and improvement.

Improving Mold Design Productivity Through Digitalization & Knowledge Driven Automation

Tooling companies face fierce global competition and are looking to the tool design through production process to reduce tool cost, reduce tool design through manufacturing lead time, and improve product quality.

Tooling companies are facing several challenges:

- The demand for shorter product delivery times
- Faster turnaround on design enhancements
- Lower supplier costs
- Increasing global competition

Now You See It – Now You Don't: The Magic of Dry Ice in Plastics

No matter how large or small of a molding operation, custom or captive, there are numerous production solutions utilizing recycled dry ice. This webinar discusses those various uses from in-machine mold cleaning that can mean the difference between mediocre performance and high-profit productivity, automated surface preparation of plastic parts prior to painting or coating , automated deflashing or deburring systems of plastic parts, and cleaning injection screws.

Energy Efficient Resin Drying with Automatic VFD and Flow Control for Your Molding Process

Processing resin upstream is a key factor to yielding a conforming product in any molding process. Energy savings is the name of the game as Wittmann Battenfeld's technology has allowed for new innovative solutions to minimize energy costs while outputting the ideal amount of dry process air for your application. Wittmann Battenfeld's variable frequency driven drying system with process flow control technology has opened the doors to energy savings. Coupling both VFD and flow control technology allows for a complete automatic central drying solution which will provide efficient, redundant, and worry free resin processing for your molding process.

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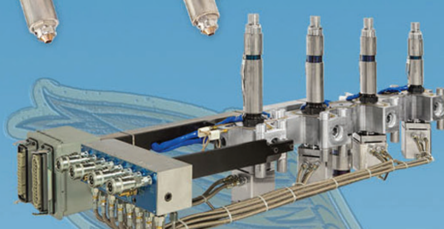

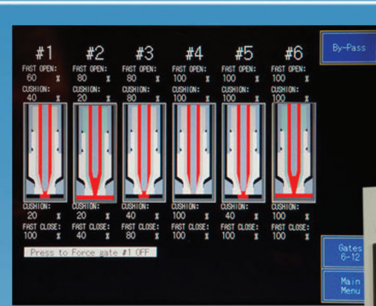

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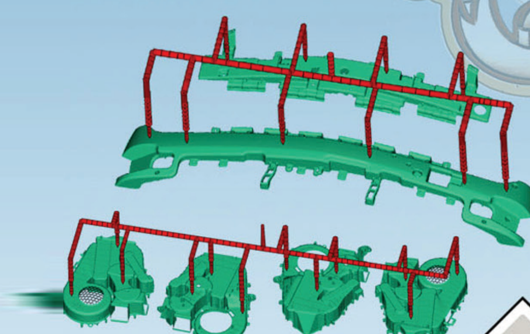
The Hot runners that feed the industry



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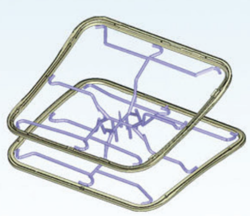

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Viscosity of Water at Various Temperatures

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've been searching for a chart listing the viscosity of water at various temperatures. I understand that in your Mold Design Seminar you include a section on mold cooling. Could you provide me with that information?

A: I do have a chart that lists the viscosity of water, measured in Centistokes, for various mold temperatures starting with the freezing point and continuing to the boiling of water. It is more correct to refer to mold it as temperature control, rather than mold cooling though. I initially found the information is an Eastman Molding Guide and credit that resource as the source of the information.

The chart is listed below:

° F	°C	Viscosity in Centistokes		° F	° C	Viscosity in Centistokes
32	0	1.79		100	38	0.69
40	4	1.54		120	49	0.56
50	10	1.31		140	60	0.47
60	16	1.12		160	71	0.40
70	21	0.98		180	82	0.35
80	27	0.86		200	93	0.31
90	32	0.76		212	100	0.28

The formula for Calculating the Reynolds Number in Si units is:

Reynolds Number = (7,740 x V x D)/n

Where:

V = Fluid velocity in feet/second

D = Diameter of passage in inches

Q = Coolant flow rate in gallons/minute

n = Kinematic viscosity in centistoke

Send your molding issuea to:

Bob Dealey

MoldDoctor@dealyME.com

IMD SEEKING NOMINATIONS FOR

SPE FELLOWS AND HONORED SERVICE MEMBERS

The SPE Injection Molding Division (IMD) encourages its members to nominate candidate(s) or self-nominate for two of the Society's distinguished memberships, namely, Fellow of the Society (Fellow) and Honored Service Member (HSM).

Fellow of the Society

To be elected Fellow of the Society, a candidate shall have demonstrated outstanding achievements in the field of plastics engineering, science or technology, or in the management of such activities; shall be sponsored, in writing, by the Board of Directors of at least one Section or Division, or by a committee of the Society organized for this purpose; shall have credentials certified by and application approved by the Credentials Committee; and shall have been a member in good standing for six years.
Detailed information on Fellow application and guidelines as well as past honorees can be found at: http://www.4spe.org/Leadership/Content.aspx?ItemNumber=5986

Honored Service Member (HSM)

According to SPE Bylaws, "To be elected an Honored Service Member, a candidate shall have demonstrated long-term, outstanding service to, and support of, the Society and its objectives; shall be sponsored, in writing, by the Board of Directors of at least one Section or Division."

Members interested in the nomination process please contact
Prof. Lih-Sheng (Tom) Turng, IMD HSM & Fellows Committee Chair, at

E-mail: turng@engr.wisc.edu **Phone: 608-316-4310**

Send Email Request

Click Here for More Information

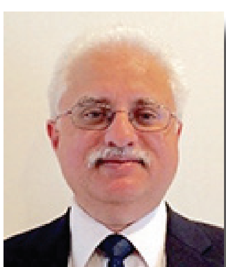
Fellow of the Society

We are proud to introduce the newest Fellows of the Society. These five SPE members are honored for their outstanding contributions in the field of plastics engineering, science or technology, or in the management of such activities. Candidates must be sponsored by an SPE Division or Special Interest Group and elected by the Fellows Election Committee on the basis of their professional record as well as written sponsorships from at least two SPE members. Only 319 members, including the new Fellows, have been awarded this prestigious title since it was introduced in 1984.

This year's Fellows, with their SPE Division and Section affiliations, are:

Dr. Rong-Yeu Chang

Dr. Rong-Yeu Chang is now the Chairman & CEO of CoreTech System (Moldex3D) Co. Ltd. Prior to his current role, he has spent more than 30 years in the research and education of rheology and polymer processing in the Department of Chemical Engineering in Tsing Hua University, Taiwan. He and his teammates founded CoreTech System Co., Ltd. to serve industrial customers with Moldex and Moldex3D series products since 1995. One of his greatest achievements is the commercialization of the academic research into CAE software, Moldex3D. Untill this day, the software has been widely employed across a variety of industries by more than 2,500 users globally to aid the design and manufacture of plastic products.



Dr. Bharat Chaudhary

Dr. Bharat Chaudhary is a Principal Research Scientist at The Dow Chemical Company. He obtained his Ph.D. and M.Sc. from Imperial College, London (U.K.) and a B.Eng. from the University of Benin (Nigeria), all in Chemical Engineering. He has over 26 years of experience leading research and development in a variety of areas related to polymer modification (particularly sustainable approaches based on blends, functionalization and crosslinking). Dr. Chaudhary has received several awards for his work; is author of 32 journal papers and 20 conference/technical presentations; and is inventor on 52 U.S. and 23 European granted patents.

Dr. Stéphane Costeux

Dr. Stéphane Costeux is R&D Fellow at The Dow Chemical Company. He earned a M.Sc. and R&D Engineer diploma from ESPCI (Paris, France) and holds a Ph.D. degree in Physics of Liquids from University Pierre & Marie Curie in Paris. Since joining Dow in 2002, he has applied his expertise in rheology, materials science, polymer processing and modeling to the design of commercial high melt strength resins and new foam materials, and to the

Fellow of the Society

advancement of nanocellular foam technology. He authored 25 patents and 40 peer-reviewed publications and is a three-time recipient of the SPE FOAMS Conference Best Paper Award.

Tom Dunn

Tom Dunn is a practitioner and manager of flexible packaging product development. While emphasizing materials and applying their features for the benefit of packaged products, he replaced paper and aluminum foil with barrier plastics for modified atmos phere snack food packaging. He managed product development for his long-time employer Printpack Inc. from a narrow $100 million product line to a broad one of over $1 billion. He has received lifetime career achievement awards from the Food Packaging Division of the Institute of Food Technologists; the Polymers and Laminations Division of the Technical Association of the Pulp and Paper Industry; and the (US) Packaging Hall of Fame. His BA and MS degrees are from Yale University.

Dr. Mridula Kapur

Dr. Kapur is a Materials Science Fellow in the Packaging and Specialty Plastics Business Unit of the Dow Chemical Company. Her research work spans various areas including a novel multifunctional analyzer approach for product quality control; catalyst-process-polymer materials science combination with application performance elationships resulting in new, enhanced performance polyethylene product portfolios to meet evolving market needs; and intellectual property protection. She is also involved in defining University/External Institute-Industry collaborations. She has 13 granted US patents and over 25 publications and conference presentations. Dr. Kapur is a past Board Member of the Society of Plastics Engineers Blow Molding Division, and current Councilor for the Engineering Properties and Structure Division.

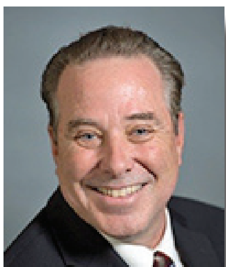
Dr. Masaya Kotaki

Dr. Masaya Kotaki is the General Manager of Kaneka US Material Research Center, Kaneka Americas Holding, Inc. located in Texas, USA since 2014. His research career includes roles as an Associate Professor at the Department of Advanced Fibro-Science in Kyoto Institute of Technology in Japan and a Research Associate at the Institute of Materials Research and Engineering in Singapore. He has focused on fundamental understanding of processing-structure-property relationships of polymer-based materials. He co-authored 4 book chapters and more than 100 ISI listed journal papers. His publications have been cited more than 10,000 times with 27 H-index. His contributions to the related scientific societies include the chairmanship of the Asian Workshop on Polymer Processing and board memberships on many plastics & polymers related societies.

Fellow of the Society

Dr. David Kusuma

David Kusuma is Vice President, Product Development and R&D Worldwide at Tupperware Brands Corporation. For the past 15 years he has been responsible for leading innovation, product development, and engineering to develop 150 to 200 new products every year, which are launched in over 100 countries around the world. Prior to Tupperware David worked at GE Plastics/Exatec as Global Manager, Design and Vehicle Engineering, to develop the use of polycarbonate as a viable alternative to glass in automotive window systems, and prior to that with Bayer Material Science. David has earned several university degrees in Design, Business, and Engineering, including a Ph.D. from Cranfield University in the UK.



Dr. Stephen McCarthy

Professor McCarthy joined the faculty of the Plastics Engineering Department at the University of Massachusetts Lowell in 1984 and is currently a Distinguished University Professor. He founded and is director of the Massachusetts Medical Device Development Center (M2D2). He is the Director of the BioPlastics and Medical Plastics Research Center where he is conducting research into biodegradable polymers and blends. He is currently the Editor for the Journal of Polymers and the Environment. He received his B.S. from Southeastern Massachusetts University, a Masters in Chemical Engineering from Princeton University, and a Ph.D. in Macromolecular Science from Case Western University in Cleveland, Ohio.

Mr. Roger Reinicker

Mr. Reinicker recently retired from BASF Corporation after 41 years in the plastics and pigments industries. After receiving a Masters degree in Chemical Engineering, he found employment with Hercules, Ciba-Geigy, and finally BASF as a Technical Fellow. His career focus has been pigments, particularity their use in the coloration of synthetic fibers and plastics; his particular love is technical service and support of customers. He joined SPE in the early 1990s, and was a board member of the Color and Appearance Division for 13 years He has authored numerous papers for RETEC® and ANTEC® and holds several patents.

Dr. Luyi Sun

Dr. Sun pioneered the injection stretch blow molding (ISBM) of polyolefins. His research led to more than 10 U.S. and international patents and patent applications. Dr. Sun's innovations helped promote the industrial application of polyolefin ISBM. Dr. Sun also conducted leading research in polymer composites and nanocomposites. His patent pending nanocoating technology has led to significant improvement in barrier and flame retardant properties. Dr. Sun is the current President of the Chinese American Society of Plastics Engineers. He has participated in the organization of the International Polyolefins Conference for over 10 years, as well as other SPE sponsored conferences. Dr. Sun is also a dedicated educator. Many students have been trained in his courses and moved into polymer industry.

Fellow of the Society

Dr. Costas Tzoganakis

Dr. Costas Tzoganakis is a professor of chemical engineering at the University of Waterloo in Canada and a Fellow of the Chemical Institute of Canada. He is also the CTO of Tyromer Inc, a start-up company of the university that uses rubber devulcanization technology based on a unique patented reactive extrusion process developed in the laboratory of Dr. Tzoganakis. He is an expert in the area of reactive extrusion of polymers and has authored several patents as well as over one hundred refereed publications. In 2015, Dr. Tzoganakis received the Heinz List Award from the Extrusion Division of the Society of Plastics Engineers in recognition of his outstanding achievements in reactive processing of polymers.

Dr. Karen Xiao

Karen Xiao is currently the Extrusion Technology Leader with Celgard, LLC responsible for product and process development and improvement in microporous membrane applications. Prior to this, she was the R&D director for an equipment manufacturing company responsible for the design and development of multilayer blown film dies and screws. Dr. Xiao currently serves on the board of the directors of the Extrusion Division of SPE; she was Extrusion Division Chair for 2014-2015. Karen received her Bachelor's degree in Chemical Engineering from the University of Toronto, and her Master's and PhD from the University of Waterloo in Ontario, Canada.

By Dallas Cada
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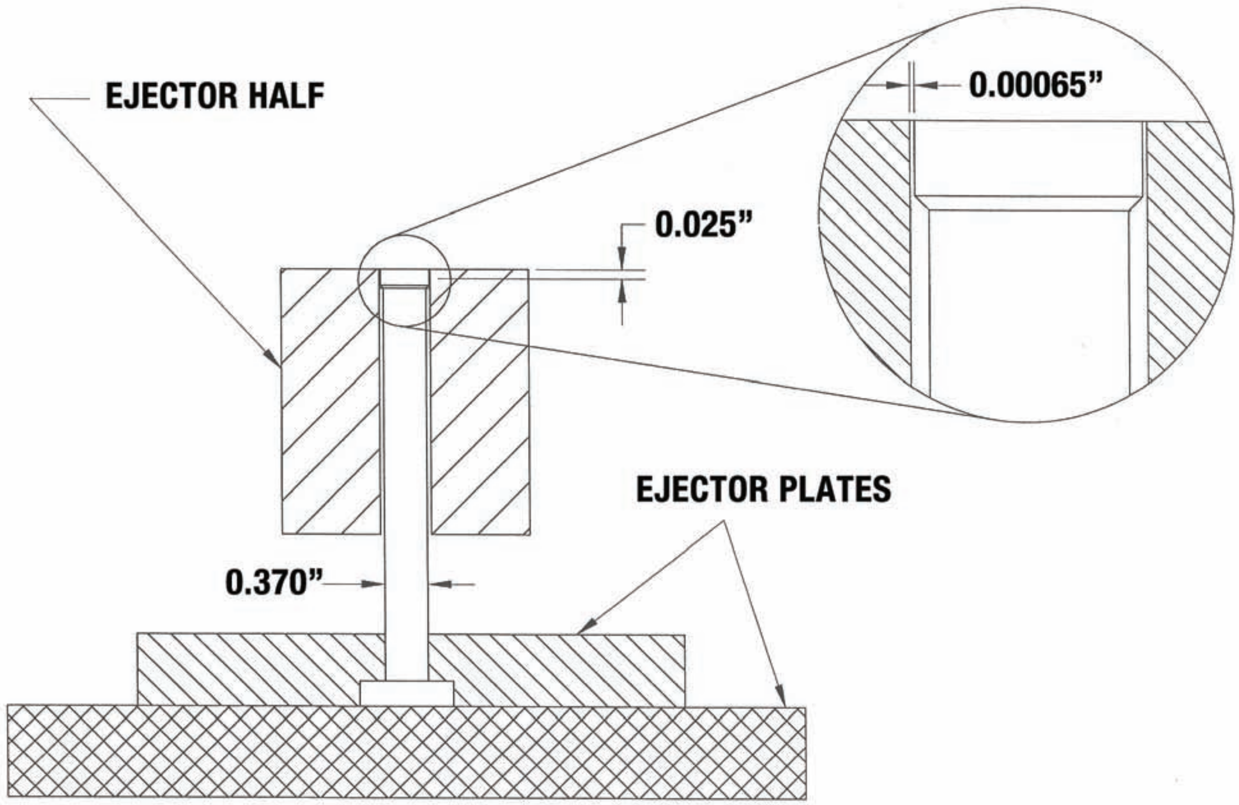
Venting Basics

Venting allows air to be dispersed within a closed mold and serves as an outlet for trapped gases. Not venting or under-venting cause's part burning, weak weld lines, internal bubbles, sink marks and high stress concentrators. To help eliminate this, vent the tool in obvious locations during the initial construction of the mold. This is not only economically correct but also gives the best tool (part) performance in the prototype stage. Vent all runners, blind corners, ejector pins and perimeter of the part out to atmosphere. Additional venting can be added as needed after the prototype stage. Remember there is no such thing as an overly vented tool! Proper planning and implementation of venting can mean higher productivity and output through reduced mold deposits and faster cycle times.

Feature: Venting Basics Continued

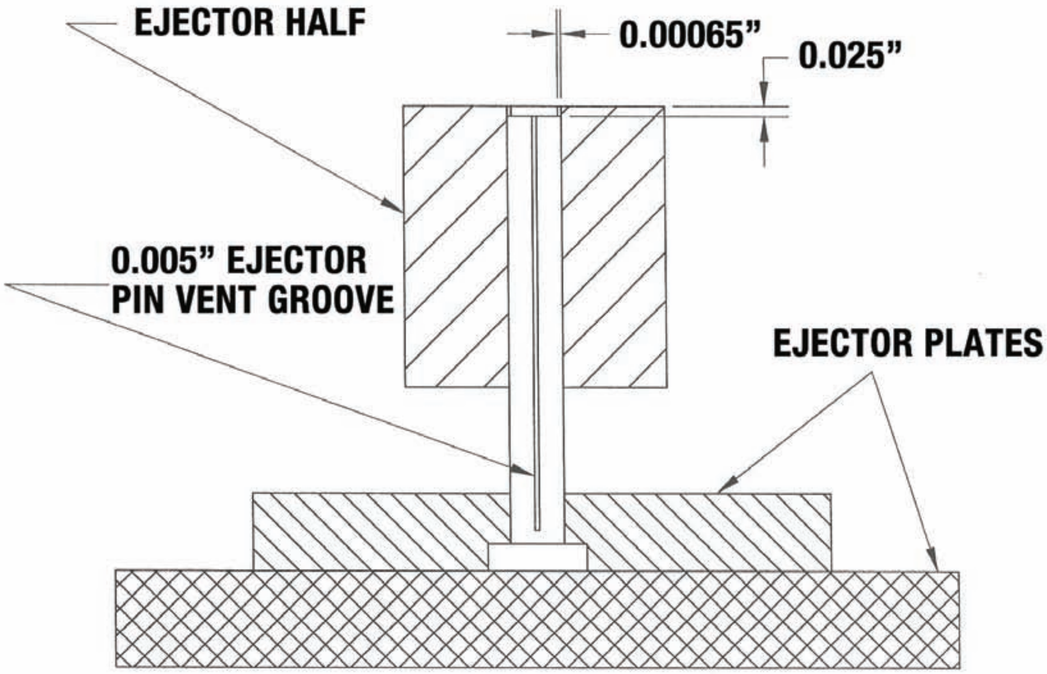


REDUCED DIAMETER EJECTOR PIN VENT

There are some processing tips such as; lower heats and slower injection speeds that can help reduce trapped gas and let air out. However, eliminating trapped gases and helping air escape really starts with tool design. Listed below are a few tips to aid in providing adequate venting. These tips will act as a guide to start with most materials and projects.

- Vent land should be 0.001" – 0.002" deep.
- Keep vent land area short, usually 0.025" – 0.050"
- Vent channel depth is usually 0.005" – 0.050".
- Vent width should never be narrower than 0.125".
- Preferred vent width is 0.250".
- Use perimeter venting whenever possible!
- Use peripheral (secondary) venting whenever possible.
- Double depth of runner vents.
- Vent runners at least 0.005" out to atmosphere.
- Ejector pins should be vented at 0.0065" per side. Two kinds of ejector pin vents are "reduced diameter ejector pin vent" and "vented groove ejector pin vent. .

Feature: Venting Basics Continued



VENTED GROOVE EJECTOR PIN

- Place ejector pins near or exactly in the center of the area where *dieseling has occurred.

*Dieseling: burns or charred areas in the mold due to (compression of volatiles in the trapped gasses).

- Remember to clean the vents occasionally while molding. Thoroughly clean vents while the mold is down and last but not least make it a part of your regular maintenance program.

Alternate Vent Systems

- Blind vent pockets eliminate built up gasses in monolithic cores and cavities. Most noted as passive vents, they are built the same as parting line or perimeter vents but are located inside the mold.
- Inserts or pocketed members can also serve as vent s if they are designed to fit in a way similar to the vented ejector pin. They must have a slot ground within to crate air passage down through the cavity plate. These vents are least preferred as they usually foul and are difficult to clear.
- There is another form of a vent called the "blind hole" vent. It is possible to drill a blind hole into which air is forced during the injection phase. Then the air escapes during the ejection phase of the cycle. Because there is no venting to the outside this blind hole eventually fills up and fails. However, it does serve the purposes if kept clean as a normal part of maintenance.
- Airvac systems automatically evacuate air and gasses from mold cavities prior to and during the injection molding phase (cycle). They provide a two-phase blow back circuit for repressurization of the cavity before part ejection and core pins. Airvac systems are noted to work very well however somewhat expensive.
- Poppet valves are positive-pressure vents. They relieve suction in the cavity and assist in ejection in the core. Active vents are always preferable to passive vents.

Feature: Venting Basics Continued

Permeable Mold Metal

- Material is ultra-permeable and has an even distributed microporosity.
- Usually done in small inserts, generally on the core side of the mold.
- Porosity allows gases to be extracted throughout the die surfaces.
- Gas burning and short shots are eliminated.
- Very expensive however it is usually only used for insets.
- The tools made of the material produce items with low-gloss finishes.

As always it is advisable to seek a good tool maker to help with adequate venting. A design engineer can help with a mold flow that can show areas most likely needed for venting. In any case, remember that too many vents are preferable to too few.

About the Author

Dallas Cada is a highly trained plastics engineer with over 20 years of sales support experience. Owner of a plastic consulting business (DDC Consulting), his experience includes technical service, application development, market engineering, injection molding, design, tooling, material suggestions and problem solving for plastic manufacturing companies. For more information with troubleshooting plastic problems or helping with new plastic applications, contact Dallas Cada by e-mail at dallascada@charter.net. Contact Dallas by phone at (507) 458-5785 or (507) 452-1584 www.ddcconsulting4@webnode.com.

Feature: Re-Grind

By Eric R. Larson, P.E.
Chief Engineer of Art of Mass Production (AMP)
eric@artofmassproduction.com

Should You Use Re-Grind? The Simple Answer: Maybe

I just returned from a design conference sponsored by the Society of Plastics Engineers, with support from the Rhode Island School of Design, the Industrial Designer's Society of America, the Design Management Institute, and others. It was a fantastic conference – with lots of interaction. I participated in a panel discussion on the effective use of plastics, and the discussion covered a wide variety of topics, including perceptions of quality and performance.

During the Q&A session, someone asked a question about the use of re-grind. He said that they use a number of high precision plastic parts, usually in black but also in other colors, and their molders frequently ask whether they can use re-grind material in the molding of the parts.

What is Re-Grind?

Re-grind is a term used to describe a resin pellet that has been produced by chopping or grinding larger chunks of plastic that were produced during a previous molding process. These chunks could be remnants of an earlier molding operation (flash, runners, gate vestiges, etc.), non–conforming or rejected parts, left over parts, etc. The re-grind is then re-used, usually by blending it with pellets of the virgin resin, and then molding parts using that blended mix. The amount of allowable re-grind is usually described on a percentage basis, typically ranging from 0 to 10%. While technically regrinding is a type of recycling, the term re-grind is commonly used to describe an in–the–factory process, and is rarely considered to be a recycling process.

The use of re-grind is often a subject of heated debate, with advocates who describe the cost savings and detractors who say that it is a bad idea, because once the resin has been through a melt processing cycle the molecular weight distribution (MWD) of the polymer has been compromised and the material properties have been affected. However, it is important to remember that even prime virgin resin has been through at least one melt processing cycle, and if it has been modified or compounded it may have gone through several. One of the responsibilities of the resin supplier is to ensure that the resin has a MWD within a certain range, and that its physical and mechanical properties meet certain specifications. Most resin buyers have a protocol in place to verify compliance with these specifications as well.

Theory vs Practice

My response to the question on the use of re-grind was a qualified yes, provided that you have proper process control of the entire system, including the sourcing of the raw material, the re-grind process, and the remixing process itself. All you need to do is verify the MWD of the blended resin (with whatever amount of re-grind added) is within an acceptable range, and that it still meets the required specifications and you should be fine. What I should have added:

While this method is true in theory, in practice it may be difficult to do (if not impossible).

For starters, you need to control the amount of re-grind that is being used, as well as the quality of the re-grind. If the molder is using re-grind from rejected parts, were they rejected because the material was degraded during the molding process? This degraded material must be eliminated from the re-grind supply stream. You then need to control the amount of re-grind that is being blended back in, and verify the consistency and performance of the resulting blend. Unfortunately, most molders don't have the ability to verify the properties of a molded resin, let alone determine the MWD.

Point and Counterpoint

After the session, I had a discussion with another veteran of the plastics industry, with decades of experience in the cell phone industry. He was strongly opposed to the use of re-grind material. "When you are molding in China, you just don't know what they are going to be doing," he said. My argument was that there are good molders and bad molders – even in China – and if they use an ISO certified process and properly control the handling and use of re-grind, and you can verify the blended material meets specifications, you should be OK. "But you're now using a different material than what you qualified the tool with," he replied.

His point is well taken. When you use re-grind, you are in essence making a resin blend - consisting of pure virgin resin with a small amount of re-grind resin blended in. Even if you can control all the factors in the use of re-grind process, and can verify that new blend has a molecular weight distribution (MWD) within an acceptable range, and the physical and mechanical properties of the blend still meet specifications, you still have a slightly different material than before. It is a subtle difference, but it's there. Also, if there are additives in the resin - impact modifiers, structural reinforcements, colorants, processing agents, etc – they will also gave gone through an additional melt cycle, resulting in additional subtle differences from the virgin resin.

All these subtle differences may have unintended consequences, especially in complex multi-cavity tools making high precision parts. You may find slight variations in mold shrinkage, or cosmetic appearance, or the amount of flash in the molded parts. Dimensions may now be out out spec - even though you are using the exact same mold in the exact same machine with the exact same control parameters that you used during the qualification process. This is one of the reasons many companies avoid the use of re-grind. You could address this by using re-grind during the qualification process itself – and then verifying you use the same resin blend during actual production – but that takes foresight and planning, as well as skill, and a trust in the expertise of the molder.

There is always a certain amount of trust in the supply chain, and sometimes that trust is taken advantage of. There are brokers and distributors who will put an alternate resin in the packaging of a major material supplier (in essence, selling you a counterfeit material), and there are molders who will use a different material from a different supplier than your approved source, and sometimes even an entirely different type of material. This is why we have certificates of compliance, verification procedures and audits.

Consistency is Key

I am a firm believer in blends (Bourdeaux and Meritage wines are some of my favorites, and they are all blends), but I am also a firm believer that quality is achieved through proper control of the manufacturing process – and the consistency of the raw material is a critical parameter. When you specify the use of 100%

virgin resin (e.g. no re-grind allowed) you are basically relying on the resin supplier to ensure that consistency. When you allow for the use of re-grind, you are adding a variable to the mix. The molder now becomes its own material supplier, using a blended material that is a mix of a virgin resin (purchased from a resin supplier) and a re-grind resin (that has been through one or more additional melt cycles at the molder). You are now relying on the molder to ensure the consistency of the resulting blend.

Using re-grind in the injection molding process essentially means you are using a resin blend. The end result can be a mangy mutt, an elegant Bordeaux, or something in between.

In addition, we should make a distinction between allowing for the use of re-grind, and requiring the use of re-grind. When you allow for the use of re-grind, you are basically saying:

You can use a range of resin blends, starting with a pure virgin resin of material A, which is then blended with re-grind resin made from the same material. There is no requirement for the amount of re-grind that is blended in, as long as the percent is less than X percent, so the blend ratio can vary anywhere from zero to X percent.

As you can imagine, this can result in a wide variation in the material that is actually being used in the molded part, depending on the amount of blending that is being done.

When you require the use of re-grind, you are specifying the ratio of the blended resin. You are basically saying:

Use a resin blend consisting of pure virgin resin of material A, blended with X percent of re-grind resin made from the same material. Blend ratio must be within plus or minus Y percent.

You could then also add another note, saying something to the effect of:

Molder to verify the consistency of the final blend meets international standards for resin consistency.

The key question: can you rely on your molder to do all that?

The Bottom Line on Re-Grind

If you are considering the use of re-grind, I recommend you explore the following:

- Do you want to allow the use of regrind? Or do you want to require the use of regrind?
- What additives are in the resin, and what is the effect of a melt cycle on those additives?
- Does your molder have a means to verify the quality and consistency of the re-grind material being used?
- Does your molder have a means to verify the quality and consistency of the new blended resin?
- Will the new blended resin provide you with the performance you need in your molded parts?

If the answers to these questions are favorable, then go ahead and re-grind away.

About the Author:

Eric R. Larson is a mechanical engineer with over 30 years' experience in plastics design. He has helped develop products ranging from boogie boards, water basketball games and SCUBA diving equipment to disposable lighters, cell phones and handheld medical devices. Eric is an active member of SPE, and is Chief Engineer of Art of Mass Production (AMP), an engineering consulting company based in San Diego, CA. AMP provides services to manufacturing companies in the consumer electronics, wireless, and medical device industries. For more information contact Eric at eric@artofmassproduction.com or by phone: 619-269-0184

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By Gabriel A. Mendible, Jack A. Rulander,
Stephen P. Johnston
University of Massachusetts Lowell, Lowell, MA

Thermal Anaylsis of Conventional and Rapid Tooling for Injection Molding

The thermal behavior of inserts manufactured via rapid tooling was compared to conventional machined inserts. Machined T-420 stainless steel, direct metal laser sintered bronze and jetted digital-ABS photopolymer inserts were studied. Full 3D models of the inserts, part, and mold geometry were created and analyzed via computer simulation of the process. The thermal gradients and their effects on the part geometry (shrinkage and warpage) were studied for each set of inserts. The thermal properties of the inserts were found to have a significant impact on the processing variables and the part quality. The results showed that the digital ABS inserts present the greatest variance in part dimensions, as well as the highest temperature gradients.

Introduction

Reduced life cycle of products and the demand for faster product development times in injection molding have increased the popularity of rapid tooling. Integrating rapid prototyping techniques with injection molding allows the use of the latter in areas that, with conventional tool manufacturing techniques, would not be economically feasible (e.g. low volume productions). Applications for rapid tooling range from prototype runs to low volume final production parts.

There are a variety of techniques and materials that can be used for rapid tooling, which will dictate the durability of the tool. Based on the materials used, rapid tools may be classified as soft tools and hard tools. Although the definitions are not completely clear and overlap sometimes, soft tools are associated to low cost, low volume runs (less than 1,000 cycles) and include tools manufactured with photocurable polymers, silicones, epoxies, low-melting point alloys, etc. [1,2]. Conventional steel tools and ceramic tools are included in the hard tools category. Techniques that have been successfully used for rapid tooling include selective laser sintering (SLS), selective laser melting (SLM), stereolithography (SLA), direct metal laser sintering (DMLS), KelTool™ and casting [3].

The material and manufacturing technique not only dictates the durability of the tool but also its performance. Thermal and mechanical properties vary significantly from those of conventional steel affecting the quality of the final product. Damle et al found that polycarbonate parts molded in SLA tooling had lower strength and stiffness than from steel tooling [4]. Similar results were found by Dawson and Muzzy using atactic and syndiotactic polystyrene [5]. Harris et al. showed that shrinkage using a SLA tool was double that of an Aluminum tool for a semi-crystalline resin [6]. The differences from conventional tooling are attributed to a number of factors including rates of cooling and differences in in-mold stresses; both related to the thermal properties of the tooling materials [7]. These effects have also been studied using computer simulation. Aluru et al. simulated the mold filling of SLA molds and the structural behavior using both temperature and pressure boundary conditions. They found that temperature played a bigger role in the part dimensions compared to packing pressure. However, software limitations did not allow for analysis non-uniform transient temperatures [8].

Although the thermal behavior of SLA tooling has been extensively studied, little work was found in the literature regarding newer manufacturing techniques such as inkjet printing and DLMS. The present work evaluates the thermal behavior of tooling manufactured via PolyJet™ 3D printing technology, DLMS, and conventional machining. For this purpose, finite element analysis (FEA) software will be used to perform a transient cooling analysis of the process. This type of analysis has been successfully used to simulate the transient heat flow through the mold, as well as the temperature gradient, from process startup until steady state [9–11].

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Tooling Materials

Three manufacturing methods will be evaluated in this study: conventional machining, PolyJet™ technology, and DLMS. Conventional machined inserts were manufactured using stainless steel 420. An ABS-like photopolymer was used for the PolyJet™ inserts. Finally, the DLMS inserts were made using a bronze alloy.

To perform the simulations, reported values from the Autodesk Simulation Moldflow Insight database (2014) were used to perform the simulations (Table 1).

Table 1: Material Properties

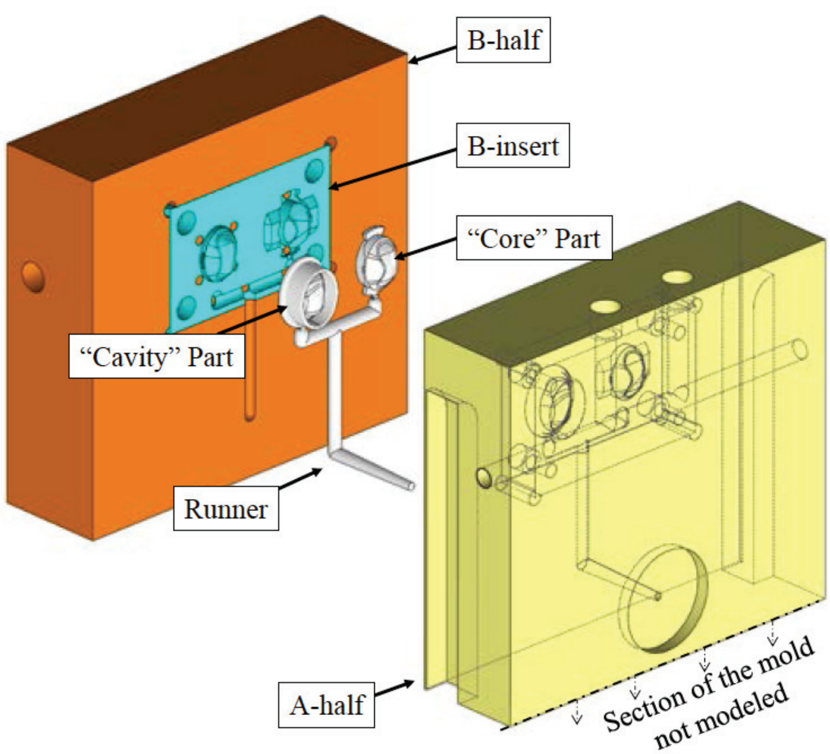
Property	Units	Stainless Steel	Bronze	Digital ABS
Density	g/cm3	7.73	8.3	1.17
Cp	J/kg-C	462	377	730
Thermal Conductivity	W/m-C	7.73	69	0.18

Simulation

The mold, part and insert geometry were modeled in CAD software. For calculation optimization purposes, only the section of the mold were the inserts are assembled was modeled. Since the cooling system has only straight through cooling lines, this simplification does not affect the numerical simulation of the thermal behavior. Similarly, the rear clamp plate of the mold was not modeled either. **Figure 1** shows the CAD representation of the mold assembly. The mold base was made using P-20 steel.

The insert geometry for the DMLS and PolyJet™ inserts was the same. However, slight differences exist with

Figure 1: Mold CAD representation.



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the conventional machined inserts due to design iterations (**Figure 2**). The influence of these differences will be addressed in the discussion section.

The CAD geometry was discretized using a full 3D mesh in Autodesk Simulation Moldflow Insight 2014 (**Figure 3**). Then, transient cooling analyses were run. These analyses evaluate the heat transfer and accumulation throughout the cycles and results are acquired once the process reaches thermal steady-state.

Experimentation

Validation of the simulation results was done using a fully electric 50 ton injection molding machine (Sumitomo SE50EV C110-22). The process parameters were optimized for the stainless steel inserts. These parameters had to be modified to achieve a stable process for the ABS-like and bronze inserts.

Due to the low thermal conductivity of the PolyJet™ inserts, the coolant temperature was set 17°C lower than for the other inserts to prevent overheating... Likewise, the cooling time for these inserts was set to 50s for the part to solidify and eject properly. The mold open time was also increased to provide time to cool the insert between cycles, giving a total cycle time of 200s. To prevent premature failure of the inserts, holding pressure and injection speed were also adjusted. Process settings for each tooling are shown in **Table 2.**

The process was run in semi-automatic mode for all the inserts.

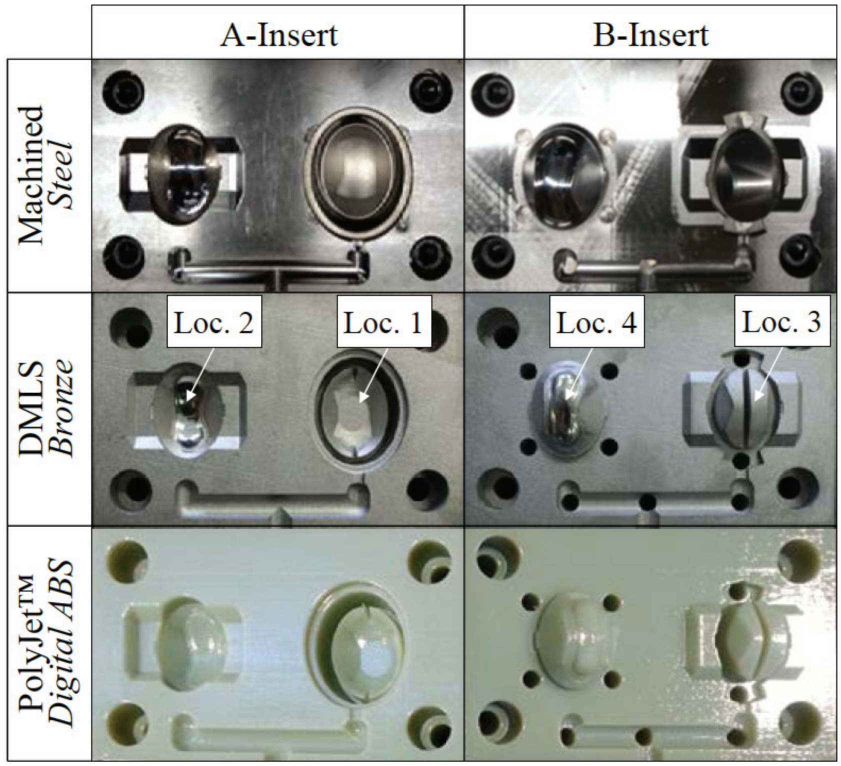

Figure 2: Mold tooling showing locations for temperature measurements

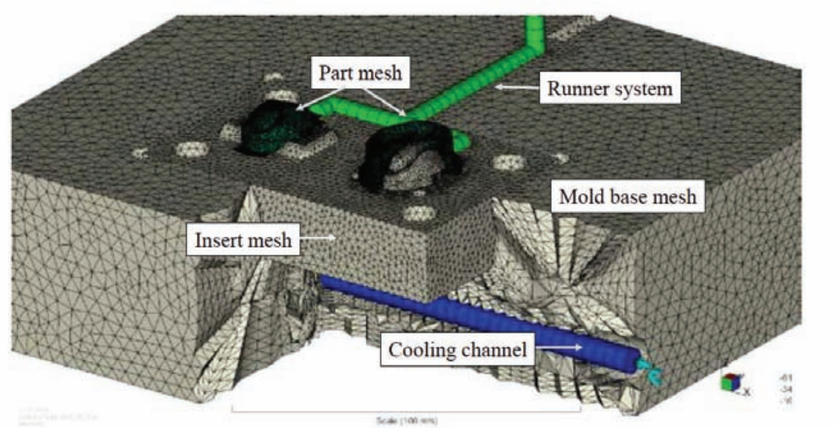

Figure 3: Mesh representation of the model (A-half hidden, mold and part meshes cropped)

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Table 2 Process Settings

	Machining (Steel)	DMLS (Bronze)	PolyJet™ (Digital ABS)
Coolant Temp. (°C)	49	49	32
Inj. Speed (mm/s)	250	250	20
Hold Press. (MPa)	18	5	7
Hold Time (s)	10	8	30
Cooling Time (s)	12	10	50
Cycle Time (s)	35	28	200

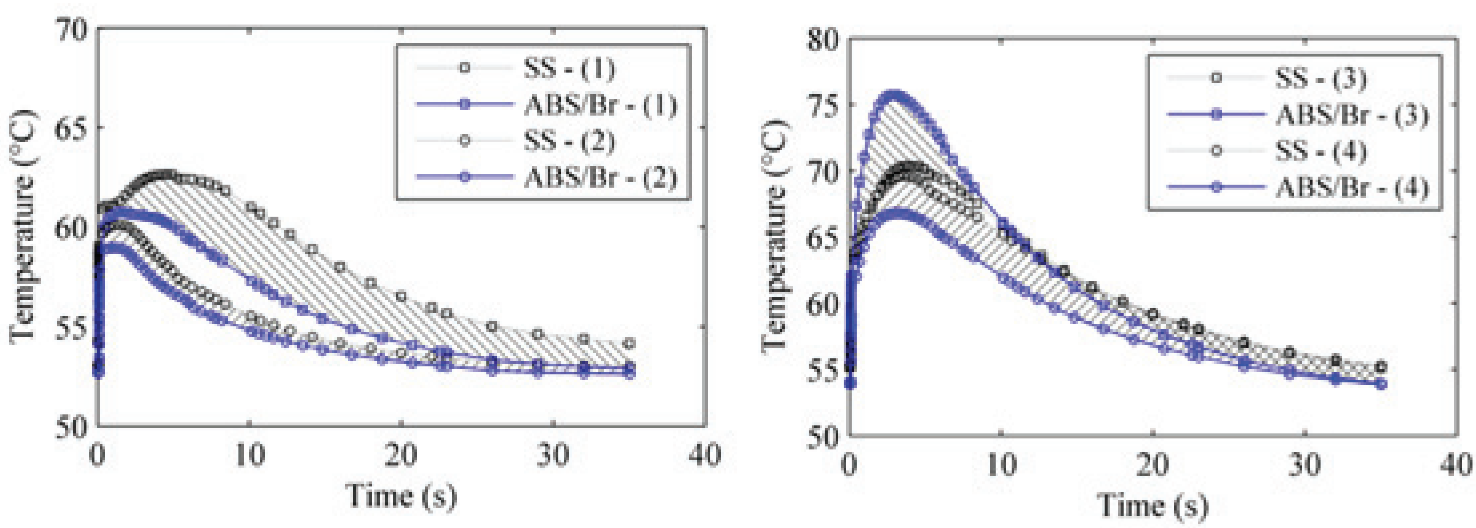
The stainless steel and bronze tools were run for 500 cycles each, and the digital ABS tool was run for 100 cycles. Sampling was done every 50 cycles for the stainless steel and bronze tools, and every 10 cycles for the digital ABS tools.

All trials as well as simulations were performed using a polypropylene PP1901-01 manufactured by A. Schulman, Inc. The specific heat of this material was tested in-house via differential scanning calorimetry (DSC) in order to improve the accuracy of the simulations.

Results and Discussion

To assess the influence of the geometry changes on the results, a computer simulation was performed on each geometry. In order to isolate the geometry effect, the process parameters and material properties were set equal and the temperature at the locations indicated in Figure 2 was compared throughout the cycle. The temperature values are presented in **Figure 4,** where the hatched area represents the temperature difference due to the geometry changes. The greatest temperature variations are observed in locations 1 and 3 which is where a rib was added to the geometry, increasing the amount of hot melt in that area. The maximum temperature difference in these locations is 6.8°C while on locations 2 and 4 is 3.5°C. Hence, this work will focus only on the latter two, which form the "Cavity" part.

Figure 4: Thermal comparison of studied geometries.



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The simulated temperature gradient of the mold (cross section through the inserts) at the start of the cycle is shown in **Figure 5** for the three inserts studied. It is noticed that the PolyJet™ inserts show the greatest difference in temperature, not only within the insert but also between the insert and the mold steel. These set of inserts also exhibit the highest temperatures in the insert and on the part at ejection **(Table 3)**. The DMLS (bronze) inserts maintain the overall lowest temperatures and have a more uniform temperature than the PolyJet™ inserts.

Table 3: Comparison of Process Variables

	Machining (Steel)	DMLS (Bronze)	PolyJet™ (Digital ABS)
Max. Part Temp. at Ejection (°C)	61.1	54.9	100.2
Max. Temp. Mold Insert (°C)	79.3	65.7	149.8
Avg. Temp at Mold Close (°C)	54.5 ± 0.5	53.5 ± 0.1	58.0 ± 3.0

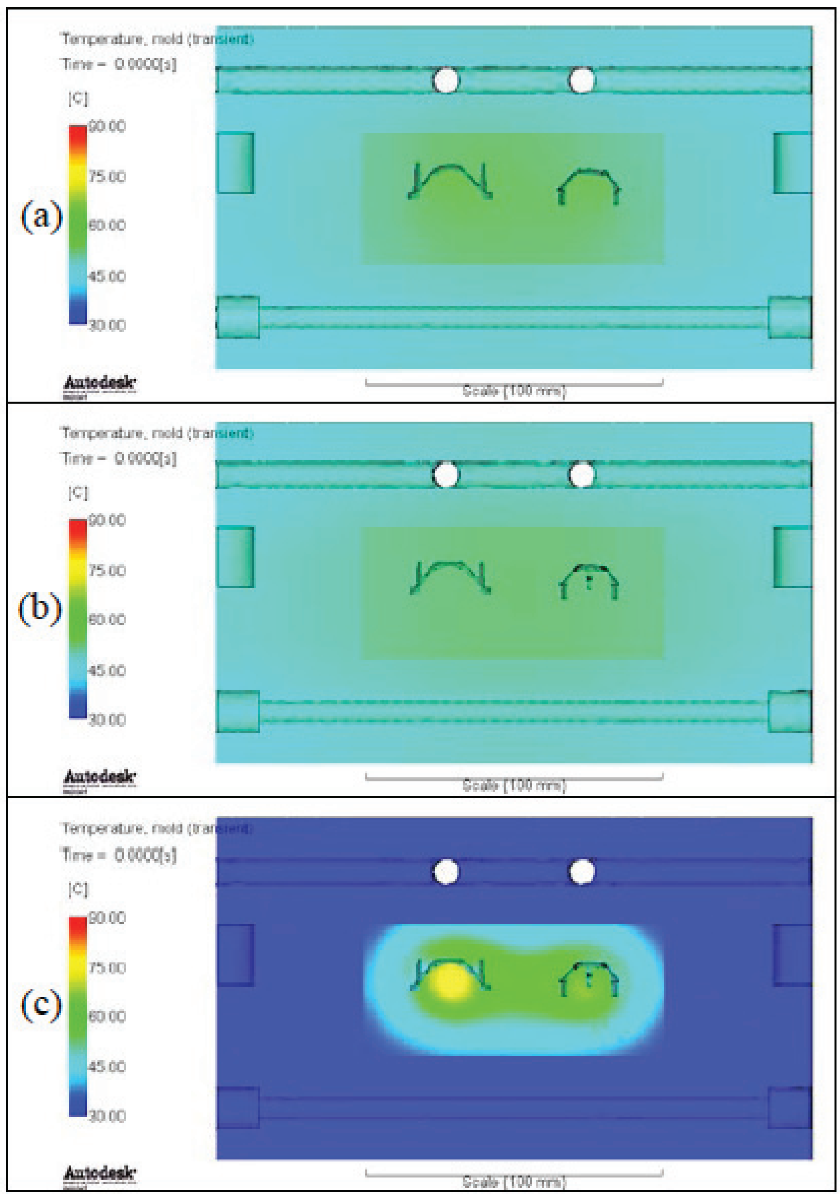
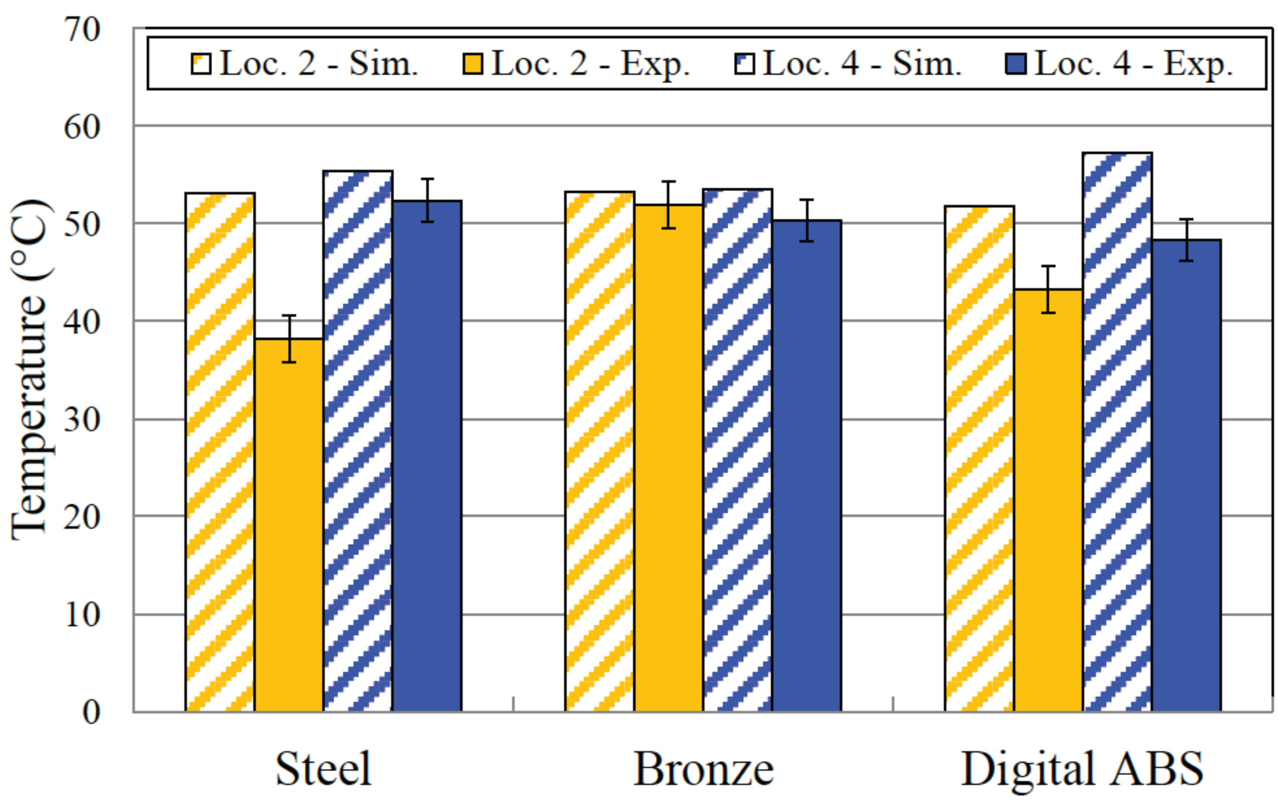


Figure 5:
Thermal gradients of
(a) conventional machined,
(b) DMLS and
(c) PolyJet™ inserts.

These results indicate that there is a significant difference in the cooling rate of the inserts. The digital ABS tool was processed using a lower coolant temperature and a cycle time almost 3 minutes longer than the steel and bronze inserts. In spite of which the ABS inserts exhibited higher temperatures than the other two. Dimensional stability of the molded parts is affected by these differences in cooling rate, as well as the higher ejection temperature.

The surface temperature was measured at mold opening using an IR pyrometer. The measured values are compared to the predicted values on **Figure 6.** The bronze inserts exhibited uniform temperatures between locations 2 and 4, while for the steel and Digital ABS inserts, the temperature at location 4 (core) was higher. This suggests that the bronze inserts accumulate less heat at the core as expected due to their high thermal conductivity. It is noticed that, although the trends are similar, the magnitude of the predicted temperatures is significantly higher than the observed values for the steel and Digital ABS inserts. Temperature readings by IR pyrometry depend on the emissivity of the material. This property is directly related to the penetration depth of the signal which, if unknown, may be a source of error for the reading [12]. Moreover, reflective surfaces such as the polished surface on the stainless steel inserts have a low emissivity which can produce unreliable results. However, to prevent damage of the polished surfaces, non-contact pyrometry has to be used in this study.

Figure 6: Simulated and experimental insert surface temperatures at locations 2 and 4.



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Simulated and measured shrinkage values are presented in **Figure 6.** For all the shrinkage predictions, the steel inserts showed the lowest values, followed by the bronze inserts and the highest shrinkage was exhibited by the digital ABS tools. This trend is observed both in flow and transverse direction results. A clear trend cannot be established from the "in flow" experimental results due to the magnitude of the variation. However, for the transverse direction results, experimental results have a similar trend than the predictions although the magnitude of the shrinkage is higher.

Accurate shrinkage predictions are highly dependent on the material properties and crystallization models. Further characterization of the resin may improve the predictions. Similarly, the degree of crystallinity of the produced parts should be assessed. The effect of crystallinity variation may not be limited to the dimensions of the part, but also to its mechanical performance.

Slower cooling rates may induce higher degree of crystallinity in the polymer which would increase the shrinkage. Moreover, since the part is being ejected at a higher temperature, it cools down to room temperature being unconstrained for a longer period than parts made with the steel or bronze tools. Both effects would contribute to the observed higher shrinkage.

The digital ABS tools also presented the highest variation in the shrinkage values. This may be a consequence of the reduced heat transfer rate due to the low thermal conductivity of this material. Differences in the experimental and simulated trends may be due to variations in the thermal properties used for the computer simulation. Previous work on this area has demonstrated that the material properties play a critical role on the simulations [13].

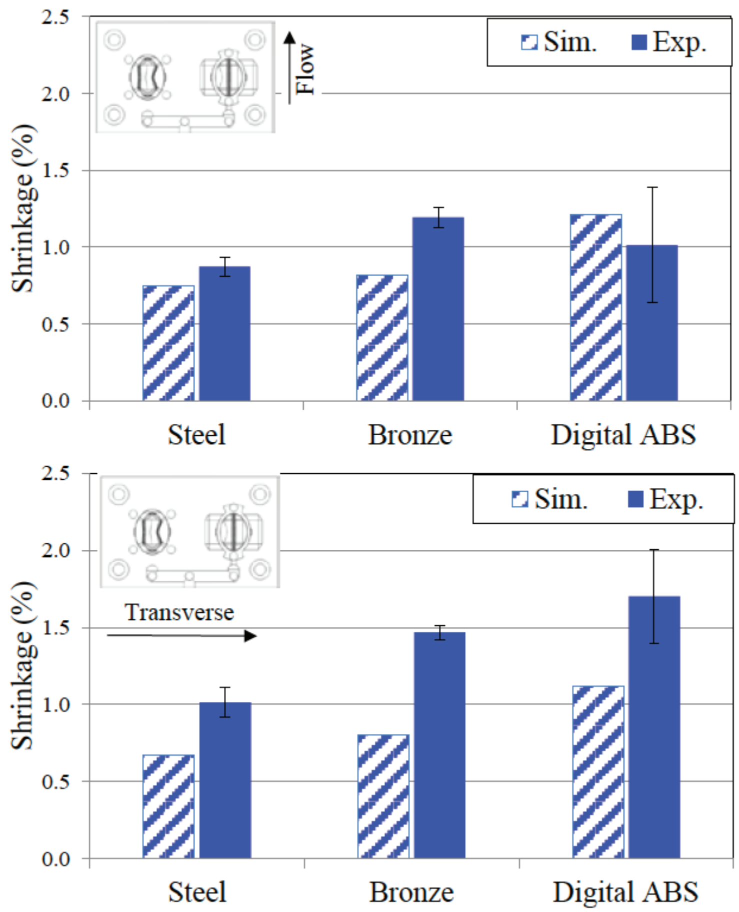

Figure 7: Experimental and simulated shrinkage in the flow (top), and transverse (bottom) directions.

Conclusions

Advancements in rapid tooling technology permit for quick tool development at lower costs than conventional techniques. However, the properties of rapid tools vary from conventional ones affecting the process as well as the product quality. This is particularly true for their thermal properties. Dimensional tolerances must be carefully evaluated to select the proper technique, as well as the intended production volume.

For the evaluated inserts, the digital ABS had the greatest variance in shrinkage as well as long cycle time and high temperature differences. However, this type of inserts may be quickly and fairly easily produced.

Future Work

Further work in this area include characterization of the thermal properties of the insert materials via differential scanning calorimetry, as well as assessing the degree of thermal cure of the ABS-like photopolymer inserts and the influence of these on the thermal behavior of the tooling.

Acknowledgements

The authors would like to thank Stratasys, Ltd for providing the inserts used in this study, and Vista Scientific LLC for the support for this research. This paper does not represent the opinions of Stratasys or Vista Scientific.

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Achieve Plastic Part Dimension Accuracy Through 3D Volume Shrinkage Compensation Method

In the injection molding industry, mold dimension accuracy is the most important factor to achieve high product quality and mass production ability. In addition to the help of the know-how of experienced engineers, the utilization of industrial global compensation method is a common practice used in the industry to achieve mold dimension accuracy.

Industrial global compensation is a method to apply the average shrinkage value of the injected part to compensate the product dimension. This is a good method to use when the shrinkage behavior of the injected part presents the consistent values throughout the whole part. However, the shrinkage values at different sections of the part are never uniform and some even exhibit a greater difference from one another. Thus, the industrial global compensation method is not the suitable approach to be applied in the real world of complex plastic product designs. Traditionally speaking, the trial-and-error method is a common practice used in the industry to produce plastic parts that meet the product requirements; however, the use of this method can be costly and also time-consuming. On top of this, the mold life can be drastically shortened due to the countless mold trials and modifications.

In order to avoid the problems mentioned above, CAE technology has been widely applied in the injection molding industry to help diagnose the causes of potential issues in the manufacturing process. Thus, common product defects such as warpage can be found at the early stage of product development to ensure product dimensional accuracy and assembly precision. To tackle the warpage issue head-on, Moldex3D has proposed a new "3D Volume Shrinkage Compensation Method (3D VSCM)" to improve the warpage problem. This method is to use different shrinkage values of different sections of the injected part to compensate the product dimension so that the targeted dimensional accuracy can be achieved throughout the whole injected part.

The following is a schematic flowchart of 3D VSCM. **Figure 1** is an L-shape model. **Figure 1** (a) is the desired geometry and dimension of Target Design (TD); (b) is the result of Moldex3D's warpage Simulation on Target Design (STD). Next, since the shrinkage is three dimensional, to give better understanding, we define the shrinkage as –x, -y, and –z mm in three axes, respectively. Then, in order to compensate, the

Achieve Plastic Part Dimension Accuracy

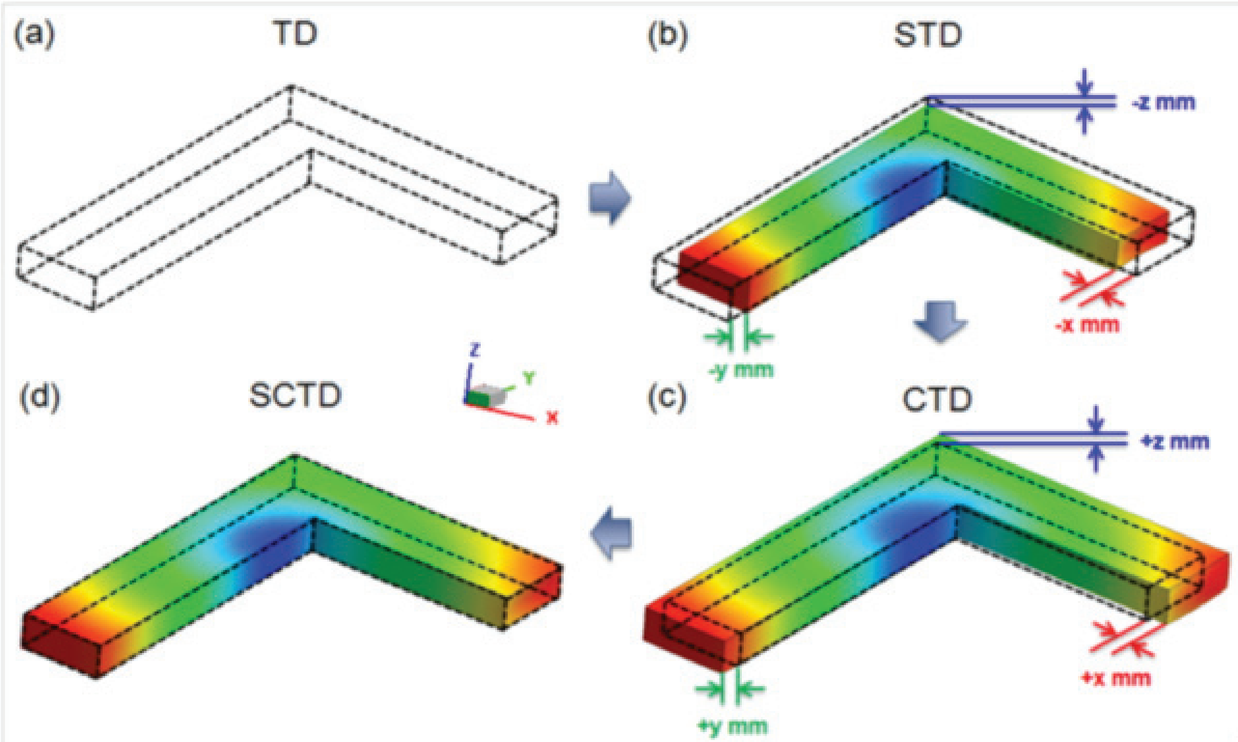


Figure 1: A schematic flowchart of 3D VSCM
(a) TD: Target Design (with desired dimension)
(b) STD: Simulation result of the Target Design (TD)
(c) CTD: Compensate Target Design is the modified design with the reverse of STD shrinkage
(d) SCTD: Simulation result of the Compensate Target Design (SCTD)

original design (TD) is revised with reverse of shrinkage. After revision, the modified design is shown as Compensate Target Design (CTD) (Fig. 1 (c)). Lastly, we performed a simulation on this CTD design. Fig. 1 (d) is the result of Simulation on Compensate Target Design (SCTD). We found that after this compensation, SCTD result is very close to TD.

We will use a mobile phone case as an example for 3D VSCM demonstration. Its geometry and dimensional specification is shown in **Figure 2**. There are twelve specification points with different tolerances on the mobile phone for the assembly purpose (**Figure 3**).

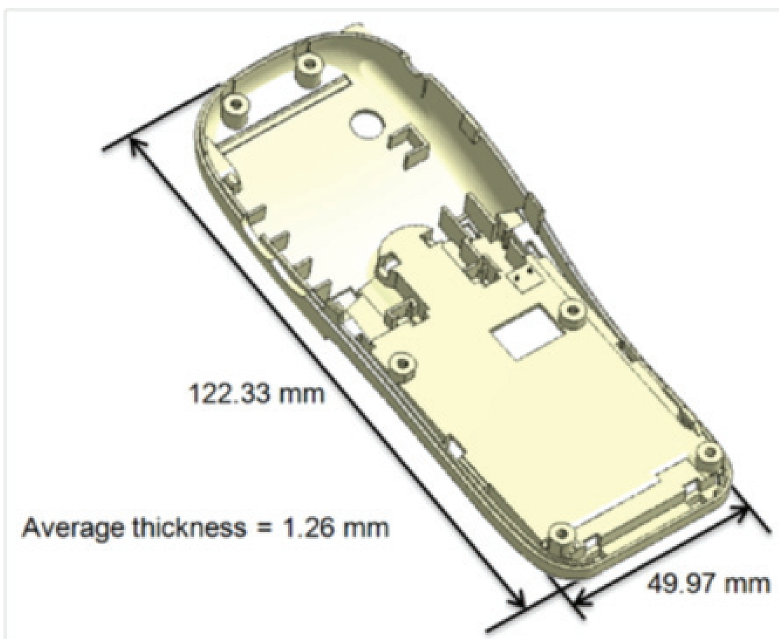


Figure 2: The geometry and dimensional specification of the mobile phone

Achieve Plastic Part Dimension Accuracy

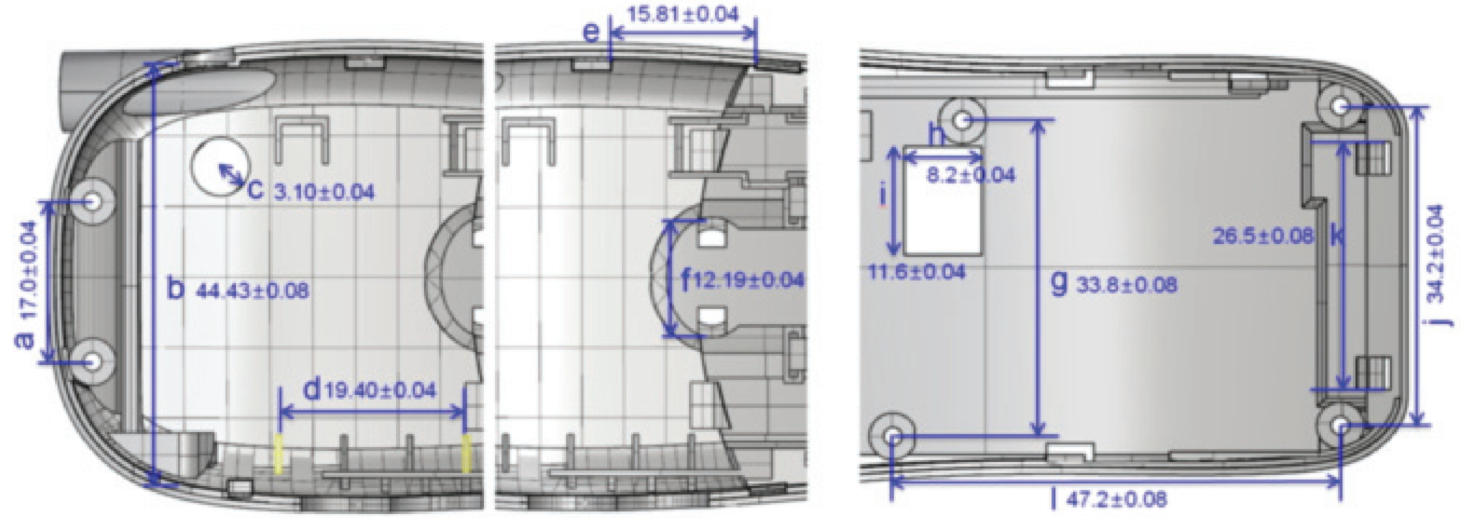


Figure 3:The mobile model is divided into 3 sections (top) and a to l are the 12 specification points with different tolerances (bottom)

Figure 4 is the 3D VSCM simulation results of the mobile phone. As shown below in STD-TI, the deviation of each specification point is not the same. That means the shrinkage direction of each specification point is different. We further apply the reversed shrinkage to compensate TD and the revised model, CTD2 is the modified design. The simulation result of CTD2 is SCTD2, which shows the 12 specification points all adhere to the desired dimension. The results have proved that 3D VSCM is the most ideal method to solve warpage issues; it not only helps reduce the number of mold trials and production costs, but also helps expedite the overall manufacturing process effectively.

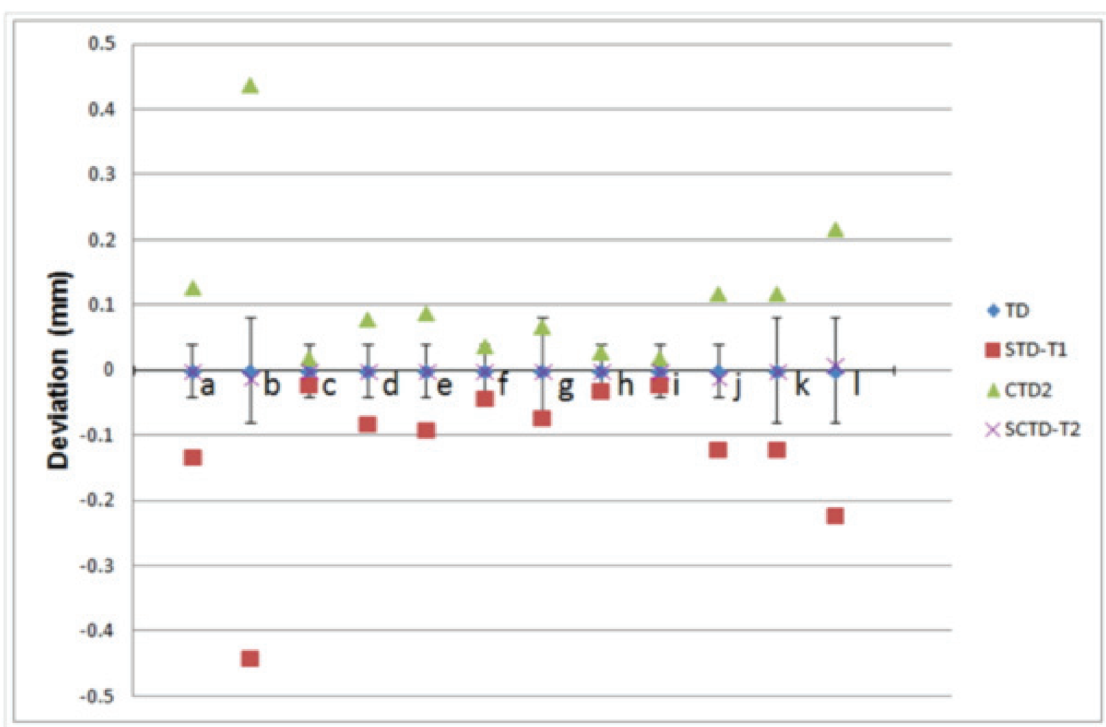
Figure 4: 3D Volume Shrinkage Compensation Method (3D VSCM)

TD: Target Design

STD: Simulation result of the Target Design (T1: Original process)

CTD2: Compensate Target Design, applying the reversed 3-dimensional shrinkage to compensate TD

SCTD2: Simulation result of the Compensated Target Design



IMD Board of Directors ANTEC/Business Meeting

May 22, 2016

Indianapolis, IN

Submitted by David Okonski

Welcome – David Okonski & Raymond McKee

(Past) Chair David Okonski called the meeting to order at 8:00 AM and welcomed all attendees. David thanked the Board of Directors for all their support and work during his tenure as Division Chair and then proceeded to pass the gavel to incoming Chair Raymond (Ray) McKee. Ray also welcomed all attendees and introduced our invited guests: 1) Dr. Joseph Lawrence of the Polymer Institute and Center for Materials and Sensor Characterization (CMSC) at the University of Toledo, Ohio and 2) Sriraj Patel who is the Director of Research and Development for Currier Plastics; both individuals expressed their interest in joining the Injection Molding Division (IMD) Board of Directors.

Chair Ray McKee appointed Joseph Lawrence and Sriraj Patel to the IMD Board for a one year term ending at ANTEC 2017.

Aside: Another individual – Lynzie Nebel, Project Engineer for MTD Micromolding – expressed interest in joining the IMD Board of Directors at the 2016 ANTEC IMD Networking Reception on the evening of May 24th, 2016. After the completion of a brief interview, Chair Ray McKee appointed Lynzie Nebel (in the presence of Secretary David Okonski) to the IMD Board of Directors for a one year term ending at ANTEC 2017.

Roll Call – David Okonski, Secretary

Present in person were:

Erik Foltz, Brad Johnson, Pete Grelle (Technical Director), David Kusuma, Ray McKee (Division Chair), Kishor Mehta, David Okonski (Secretary), Srikanth Pilla, Tom Turng, Jim Wenskus (Treasurer), Vikram Bhargava, Joseph Lawrence (Guest), and Sriraj Patel (Guest).

Present via teleconference were:

Nick Fountas, Adam Kramschuster, Rick Puglielli, Mike Uhrain, and Larry Schmidt.

This constituted a quorum.

Absent were:

Jack Dispenza, Jeremy Dworshak (TPC & Chair-Elect), Lee Filbert, Susan Montgomery (excused to attend Council Meeting), and Hoa Pham.

Aside: During roll call, Chair Ray McKee informed the Board that Lee Filbert resigned from the IMD Board of Directors effective immediately.

IMD Board of Directors ANTEC/Business Meeting Continued

Approval of January 22nd, 2016 Meeting Minutes

The meeting minutes from the IMD Board Meeting of January 22nd, 2016 were presented.

Motion: Pete Grelle moved that the January 22nd, 2016 meeting minutes be approved, as written and distributed. Erik Foltz seconded, and the motion passed.

Financial Report – Jim Wenskus, Treasurer

For the 2015 – 2016 fiscal year, financial figures from July 1st, 2015 through April 30th, 2016 were reviewed. It was noted that the SPE Rebate amount was incorrect, but the error in rebate monies is to be corrected at the time of the next payment. Newsletter sponsorships were discussed as well as ANTEC reception monies; both funds are in good financial standing.

The proposed budget for the 2016 – 2017 fiscal year was reviewed. Estimates were provided for the starting account balance ($52,900 USD) as well as for the expenses ($35,900) to be incurred in the next fiscal year. The Division appears to be in good financial standing.

Motion: Pete Grelle moved to approve the proposed 2016 – 2017 budget. Tom Turng seconded, and the motion passed.

Pinnacle Award & Discussion of 2016/17 Goals & Work Plan – Ray McKee, Chair

Ray McKee informed the Board that the Injection Molding Division received the Pinnacle Gold Award and the Communications Excellence Award (Special Recognition) for 2016.

Regarding the Goals & Work Plan, Ray McKee stressed the importance of making our Division's goals relevant and to have reasonable metrics upon which to judge success; in particular, emphasis was placed on membership (both student and professional) as well as TOPCON attendance (including ANTEC). Ray anticipates spending a great deal of time during the Fall Board Meeting to develop the 2017/18 Goals & Work Plan.

Technical Director Report – Pete Grelle, Technical Director

Pete Grelle reviewed the final version of the ANTEC 2016 IMD Session Matrix for the purpose of informing board members of their specific moderator duties. Pete emphasized the need for all moderators to provide session feedback to SPE Headquarters.

Pete informed the Board that several meetings were scheduled during this week of ANTEC to meet with the Mold Technologies Division and the North Texas Section to discuss collaboration on future TOPCONS – update to follow. The Penn State Erie TOPCON – Innovations & Emerging Plastics Technologies Conference – is all set for June 22nd and June 23rd at the Behrend Campus; one of our board members – David Okonski – will be speaking at this event.

Pete is in the planning stages for the next webinar series and is hopeful to have the first presentation in early November of 2016. A request for webinar topics and speakers was made to the Board; please submit your ideas to Pete at your earliest convenience.

IMD Board of Directors ANTEC/Business Meeting Continued

ANTEC 2016 Update – Srikanth Pilla, TPC & David Okonski, Sponsorship Chair

Tutorial Session (Srikanth Pilla): The Wednesday afternoon session is all set and will consist of three 1 hour tutorials; the three speakers are Jeffrey Jansen, Suhas Kulkarni, and our own Vikram Bhargava.

IMD Networking Reception (Srikanth Pilla & David Okonski): The May 24th evening reception is all set with a start time of 6:30 PM in the White River F Ballroom at the J. W. Marriott. Reception cost is estimated to be about $16,200 USD. The request for help in setting-up the display table tops for our Gold and Silver Sponsors was made by Sponsorship Chair David Okonski. David also informed the Board that the IMD will be marketing itself to SPE members and would require help in manning the IMD table top display.

Communications Committee Rprt – Rick Puglielli, Chair & Adam Kramschuster, Co-Chair

Newsletter (Rick Puglielli): No communications report/update was provided.

Website (Adam Kramschuster): The IMD website has been updated with a sponsorship banner that continuously loops through the logos of our Gold, Silver and Bronze Sponsors providing recognition and value to all of our sponsors. The website has also been updated with the new leadership roles that take effect at this ANTEC; the 2016/17 IMD Board of Directors Officers are as follows:

Division Chair:	Raymond McKee
Chair-Elect:	Jeremy Dworshak
Past Chair:	David Okonski
Treasurer:	James Wenskus
Tech Director:	Peter Grelle
Secretary:	David Okonski
Councilor:	Susan Montgomery

Councilor Report – Susan Montgomery, Councilor

No councilor report was provided as the Council meeting was taking place at the same time as our IMD ANTEC/Business Meeting.

Aside: During the mid-morning Council meeting break, Susan Montgomery visited the IMD Board Meeting and informed the Board that the elections to the newly established Executive Committee will be taking place in August of 2016. Our own Jeremy Dworshak currently sits on the Executive Committee as Vice President/ Treasurer.

Membership Committee Report – Erik Foltz, Chair & Nick Fountas

Past Membership Chair Nick Fountas provided a brief update on membership numbers for the Division: about 2,500 active members, about 1,260 that have let their membership lapse, and there were 10 new members in May of 2016. The IMD is still the largest division within SPE; the next closest being the Extrusion

IMD Board of Directors ANTEC/Business Meeting Continued

Division with roughly 1,300 members. Nick emphasized the critical need to generate membership. Finally, Nick introduced Erik Foltz as the new Membership Chair.

New Chair Erik Foltz provided the Board with an update on the demographics of IMD membership; based on geography, the approximate membership is: 69% US, 20% India, 4% Canada, 2% China, 2% Europe, 1% Mexico, 1% Japan, and 1% Taiwan. Surprisingly, India is the fastest growing geographic region with regards to IMD membership while Asia has the poorest retention rates. Membership age distribution is typically between 40 to 80 years with a significant decrease below the age of 40. Erik challenged the Board to change our marketing and promotion strategy to target the young professionals in regions where the IMD has good presence. Erik also suggested appointing an Indian liaison to help maintain and promote membership at SPE events within India – there are no volunteers at present.

Nominations Committee Report – Hoa Pham, Chair

Chair Hoa Pham provided an update on the 2016 ballot results that was presented by Division Chair Ray McKee on her behalf. Re-elected to the IMD Board of Directors for a three year term (term ends at ANTEC 2019) are: Adam Kramschuster, David Kusuma, Kishor Mehta, Lih-Sheng (Tom) Turng, Nick Fountas, Rick Puglielli, and Srikanth Pilla.

Hoa also reaffirmed the following:

1) Susan Montgomery will remain as Councilor until ANTEC 2017
2) ANTEC 2017 Technical Program Chair (TPC) is Srikanth Pilla
3) ANTEC 2018 TPC is Rick Puglielli
4) ANTEC 2019 TPC is David Kusuma
5) ANTEC 2020 TPC is David Okonski

HSM & Fellows Update & Awards Committee Report – Tom Turng & Kishor Mehta, Chairs

HSM & Fellows Update (Tom Turng): Tom informed the Board that the IMD is elevating two individuals to the status of Fellow – Rong-Yeu Chang, CEO of CoreTech Systems Co., Ltd. and David Kusuma, Vice President of Product Development and R&D Worldwide for Tupperware Brands Corporation. Both individuals are to be honored at the SPE Awards Gala this Sunday (May 22nd, 2016) evening from 7 to 10 PM in the White River F Ballroom at the J. W. Marriott.

Action Item: Fellow Candidates for 2017 are due September 30th, 2016.

Vikram Bhargava volunteered to spearhead the nomination of Suhas Kulkarni for Fellow.

Engineer of the Year Award (Kishor Mehta): Kishor reminded the Board that this year's recipient of the IMD Engineer of the Year Award is Adam Kramschuster, University of Wisconsin – Stout; the award will be presented at the ANTEC 2016 IMD Networking Reception on the evening of May 24th, 2016.

IMD Board of Directors ANTEC/Business Meeting Continued

Education Committee Report – Srikanth Pilla, Chair

No education report/update was provided.

IMD Outreach Report – Ray McKee, Division Chair & David Okonski, Past Chair

David Okonski provided the Board with an update of IMD activities with the Detroit Section and the Automotive Division. David was happy to report that the partnership with the Detroit Section and the Automotive Division on the AutoEPCON Conference (May 10th, 2016) was very successful; both the Detroit Section and the Automotive Division viewed the participation of the IMD as very constructive and complimented the IMD on providing great technical content. The AutoEPCON Conference was a success in that it generated more revenue and attendance than past conferences, and the IMD will realize a profit from its participation. The IMD has been invited back to participate in the 2017 AutoEPCON Conference as a full conference partner.

Old Business – Ray McKee, Division Chair

No old business was discussed.

New Business & Round Table – Ray McKee, Division Chair

David Okonski expressed his desire to formally create a Sponsorship Committee that would report directly to the Division Chair. The purpose of this committee would be to gather the necessary funding to finance IMD Board activities that would include, but not be limited to, 1) Board Meetings, 2) the ANTEC Networking Reception, 3) any student activities associated with ANTEC and the SPE as approved by the IMD Board of Directors as well as 4) other items deemed essential by the IMD Board of Directors that are contained in the annual IMD Goals & Workplan. David presented the background for the necessity of establishing a Sponsorship Committee and thus fulfilled the First Presentation requirement of the proposed Sponsorship Committee amendment to the bylaws.

Action Item: Kishor Mehta is to review the First Presentation Document and make a recommendation to the Board by the Fall Board of Directors Meeting.

Adjournment – Ray McKee, Division Chair

Motion: Srikanth Pilla made a motion to adjourn the meeting. Kishor Mehta seconded, and the motion carried.

The meeting was adjourned at 11:58 AM Eastern Time.

The next meeting will be held on October 2nd, 2016 at the Detroit Marriott Troy.

Detroit Marriott Troy
200 West Big Beaver Road
Troy, Michigan 48084

Respectfully Submitted by David Okonski
June 15th, 2016

IMD Leadership

DIVISION OFFICERS

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IMD Chair Elect
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Treasurer
Jim Wenskus
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Secretary
David Okonski
General Motors R&D Center
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Reception Chair and
TPC ANTEC 2017
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Technical Director
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Adam Kramschuster
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Erik Foltz
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Councilor, 2014 - 2017
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ANTEC Communications Committee Chair
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TPC ANTEC 2019
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Membership Chair
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Engineer-Of-The-Year Award
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Awards Chair
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IMD New Members

The Injection Molding Division welcomes 50 new members…

Odette Bouchard
Sami Siddiqui
Sam Trewartha
Laura Miles
Niraj Pavagadhi
Randy Christe
Tom Hagerty
Dan Sowle
Elaine Box
Kevin Lutkins
Steven Faes
Gary Kieffer
Vahan Shahbazians
James VanMeter
Dave Duff
Bret Levy
Robert DeMeulenaere
Sean Ogburn
Danny Allen
Ranjan Deshmukh
Eduardo Tineo
Blake Guzewicz
Thomas Smolenski
Riley Schultz
Timothy Bollard
George Soucy
Greg Mcnew
Jean Philippe S-Pierre
Zhihao Zuo
Eric Peterson
Lars Mejsner
Joe Monteleone
Barry Lyons
Jy Lovett
alex Nidetch
Dan O'Keefe
James Putnam
Bre$ Egan
William Dickinson
Eduardo Garcia
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Barry Collins
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Mansour Albareeki
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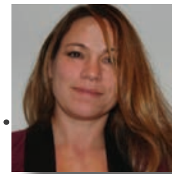
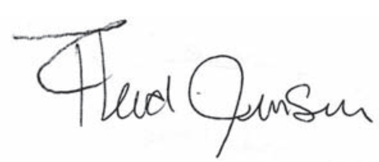


Greetings members!

I hope everyone is enjoying the summer months. I'd like to extend a big thank you to David Okonski for his dedication and time as the last year's chair and all his hard work spent on ANTEC. And a new chair has taken over for the 2016-2017 duration: welcome Raymond McKee and welcome to all our new board members and their new roles in the Injection Molding Division

The next edition of the newsletter will be this Fall. Articles, technical articles and sponsors are now being accepted for this issue. Reach out to your fellow SPE members with your knowledge, experience and support for SPE

Thank you all, stay in touch!
Heidi Jensen PublisherIMDNewsletter@gmail.com



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