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Newsletter

July 2016

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CALENDAR OF EVENTS

ANNUAL GOLF OUTING .....August 2, 2016

FALL MINITEC .....September, 2016

Upper Midwest Section
(S22) Membership
June, 2016
Section Total 309

Society of Plastics Engineers • Upper Midwest Section

July 2016 • *Volume 42*

THE SPECIALIST

UPPER MIDWEST SPE 2016 ANNUAL GOLF OUTING
August 2, 2016

OAK MARCH GOLF COURSE – 526 Inwood Ave. N. • Oakdale, MN 55128

START TIME: 10:00 AM Shotgun Start
COST: $85 per SPE Member and $95 per NON-SPE Members
If you sign up as a full foursome, you pay the $85 rate
for ALL players whether SPE member or non-member
Includes 18 holes with cart, lunch at the turn, awards and prizes.

REGISTER FOR GOLF http://www.wpgolf.com/oakmarsh/spe.aspx
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4. Advertisement in the next edition of The SPEcialist (Full size business card)

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5. Business card Handouts

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Beaumont
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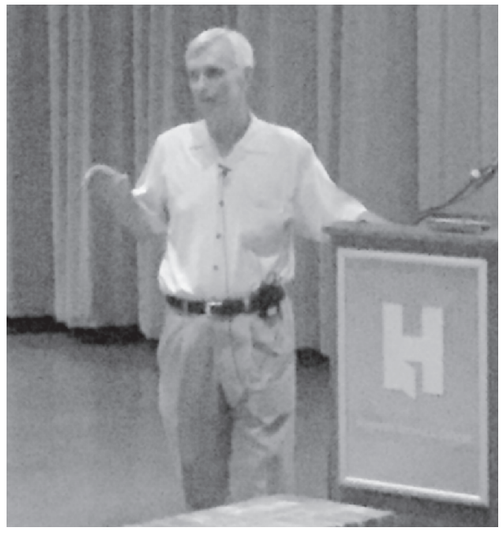
AIM American Injection Molding Institute

MINITEC RECAP *By Sean Mertes*

We had a good turnout for the screw/barrel/mixing valve mini-tech session. If you were unable to attend, you definitely missed out. We started with a dynamic speaker, Ken Lundberg who is the Plant Manager from Concor Tool and Machine. We discussed screw and barrel wear and the common problems and issues and why it happens. He also discussed the differences between Amorphous screws vs Crystalline screws and when and why to utilize them. We took a networking break and came back to Robert Dray and learned about the innovations of screw design and changes that have been made over the years, such as the Barrier screw design or Maddox mixer. After listening to Robert speak, it is no wonder why he has over 18 patents for screw design, mixing valves and check rings.

We will be announcing the Megatec date in the near future, but it will be on Drying and Material handling systems. Come learn about the innovations of drying and the difference between dessicant and vacuum drying systems. Everyone needs to dry material properly, so this is a seminar for all to attend. Hope to see you there.



Robert Dray

Ken Lundberg

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POSITIONS WANTED ON THE BOARD

Open currently or Soon to be available

Awards Co-Chair
Membership Co-Chair
House Chair
Other Board Directors for various sub-committees

Tenure: 1-2 years depending on position and sub-committee
Qualifications Needed: SPE member; part of the plastics industry;
enthusiastic, accountable, and passionate about plastics educations of the community

Contact: Shilpa Manjure (smanjure@ntic.com)

SPE EDUCATION COMMITTEE *continued from page 9*

activities including: Plastics Lab demo nights, lab tours, church activities, cancer fundraisers, and youth football coaching.

William Miller, is also a Plastics Engineering student at the University of Wisconsin – Stout. William has won the UW-Stout Chancellor's Award for academic achievement. He is on the UW-Stout Board of the SPE Student Chapter. William currently works part time for iMark Molding. There he has learned operations of injection molding, sonic welding, pad printing, and various 2nd ops. He progressed to set-up including eDART process control. He also interned at Profile Extrusions where they do single, co, and tri extrusion. He also works as a UW-Stout plastics lab assistant.

Abraham Folkerts is a Composite Materials Engineering student at Winona State University. Abe is a junior at Winona State and is a transfer student from Iowa Central Community College. He played football at both schools and has demonstrated leadership both in sports as well as leading mission trips for Love Packages and Operation Christmas Child. Abe is a member of the WSU Student Senate and is the Chair from the College of Science and Engineering. He is also an active member of the WSU SPE Student Chapter. Abe aspires to graduating with the Composites Engineering degree and one day owning his own business.

Other news

Just a reminder – SPE and SPI have extended the student subsidy to allow US students to join SPE as student members for free. The normal $31 student fee is being covered by SPI. Just go to the SPE website www.4spe.org. Please spread the word to interested students and have them join!!!

President's Remarks *Shilpa Manjure*

Hello there again!!

Year of 2016 is election year as we all know… Wait a minute, are you thinking of the Clinton-Trump elections, which has national and international media giving all the attention??? I am just referring to the SPE-UMW board elections. ☺

This May marked the end of a two-year term for this executive committee. While there are some updates to the Board of Directors, most of them are enjoying their current role and have been re-elected into their positions. Joshua Weed will be taking on the position of Secretary while Eric Cybulski will continue to help him in the role. Danny Mishek, our Past-President and Sam McCord, Board Director have decided to step down from the board for now. We would like to thank them for their dedicated contributions to the Upper Midwest region and spreading the SPE motto of education.

We still have several positions open on the board and would like to get fresh energy to keep the movement of SPE marching forward. Please see attached advertisement for details.

This spring we had the pleasure of hosting two events – The Bioplastics Topcon which was co-hosted with the Bioplastics SIG and a Minitec seminar on Extrusion. Thanks to all who attended. We are confident you walked away with a ton of valuable information. Thanks are due to Sean Mertes and Grant John our Program Chair and Co-Chair for organizing these for us. We had renowned speakers such as Prof. Ramani Narayan and Robert Dray share their knowledge and expertise with us. We will continue our series of seminars for this year and there will be two more that will be lined up. Please look out for our announcement on a full-day Megatec which this year will be a deep dive into dryers, crystallizers for plastics industry – significance, comparison of different dryers, fundamentals and more.

Our spring scholarships were given out to 5 students in plastics program at three schools - Hennepin Tech, UW-Stout and Winona State by Thomas McNamara, Education Chair. A big Thank You to all the Professors – Dan Ralph, Dr. Adam Kramschuster, and Dr. Fariborz Parsi – who are encouraging their students and taking effort in boosting their careers! Congratulations to the winners. Please find details about their background in this edition of the SPEcialist.

All work and no play makes Jack a dull boy is an old proverb. But it is especially apt for us during the summer time. Indeed, it is time for our Annual Golf Outing! So gear up for another fun day at the golf club. We promise to order great weather for you. ;-) Contact Eric Swensied at erics@harbor-plastics.com for signing up your foursome.

See you at the Oak Marsh course on August 2nd… Warm wishes for an enjoyable summer!!

Best Regards,
Shilpa Manjure

SPE Education Committee

By Tom McNamara

Our Upper Midwest Section is proud to report that we have selected and awarded five scholarships to five very deserving students. Two of the awards were Tony Norris Scholarship Awards (2-year degree programs) in the amount of $400 and three other awards were Jerome Formo Scholarship Awards (4-year degree programs) in the amount of $500.

Tony Norris Awards went to:

Christopher Miller is a Plastics Engineering Technology student at Hennepin Technical College. Chris has worked in the plastics industry for over 20 years. He currently works for St. Jude Medical as an extrusion technician. His previous employment was with Alcoa Kama and Boston Scientific. His experience includes: medical device assembly and trainer, process validation / new equipment setup, and sheet, film, tubing, over-jacketing, and co-extrusion.

Brandon Abel is a Plastics Engineering Technology student at Hennepin Technical College. Brandon has a BS and MS in civil engineering from Michigan Technological University with a minor in structural materials. He was also on the MTU Dean's list. Brandon currently works for NatureWorks as a Tech Aid doing material testing and working as a molding process technician. He is an SPE student member and also an ASCE student member.

Jerome Formo Awards went to:

Gavin Borchardt is a student in the University of Wisconsin-Stout Plastics Engineering program.

Gavin has been awarded the UW-Stout Chancellor's Award and is an Academic Honors Society member. He is the current President of the UW-Stout SPE Student Chapter and Lead / Organizer of the inaugural SPE Student Chapter Annual Golf Outing. His work history includes an internship at Phillips-Medisize and employment at Crystal Finishing Systems. He has volunteered for numerous

SPE EDUCATION COMMITTEE ***continued on page 10***

standard or steel machine back-plates using screws or double-sided tape using bolts.

With any chosen mounting option, it is critical to avoid direct contact between the nozzle and the printed mold by using standard sprue bushing. An alternative option would be to center the mold's runner with the sprue located on a regular steel plate.

5. Injection Molding Process

When using the PolyJet mold for the first time, the best practice procedure is:

- Start with a short shot and a slow injection speed. The fill time can be high as the melt does not freeze off as it enters the mold. Increase shot size until the cavity is 90-95% full.
- In the holding process, use 50-80% of actual injection pressure and adjust the holding time as needed to avoid sink marks.
- Apply normal calculated clamping force value (injection pressure x projected part area) as initial value.
- PolyJet molds have low thermal conductivity so they will require extended cooling times. For small or thin parts (wall thickness of 1mm or less), start with a 30 second cooling time and adjust as needed. For larger parts (wall thickness of 2mm or more), start with 90 seconds and adjust accordingly. The cooling time will vary depending on the type of plastic resin used.
- Minimum cooling is recommended to avoid too much shrinkage of the part on the printed cores. Extensive cooling may stress the mold when the part is being ejected and cause it to fail.
- After each molding cycle, it is critical to allow the mold's surface to cool by applying pressurized air. This will preserve part quality and mold life. Alternatively, automated mold cooling fixtures may be used.

Conclusions

The use of PolyJet 3D printed molds allows manufacturers the ability to take functional testing to a new level, by creating product prototypes from the same IM process and materials that will be used to create the final product. With this technology, companies can generate superior performance data and validate certification confidence.

PolyJet molds are unique in that they perform in the same way as metal molds but are much cheaper, easier and faster to make. With PolyJet technology, manufacturers can produce prototypes at speeds and costs far below traditional methods. As a result, 3D printing allows manufacturers to easily evaluate the performance, fit and quality of potential products before mass production starts.

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Councilor's Corner

Tom McNamara - Councilor - Upper Midwest Section

I hope those of you who were able to attend the 2016 ANTEC in Indianapolis, May 23-25, had an enjoyable and educational experience. Many new technical concepts were presented over the three days in all aspects of materials, process technology, analysis, design, etc. It is clearly the best event to obtain knowledge on a broad array of topics in our industry. The 1300+ attendees were treated with engaging plenary sessions, peer reviewed papers, diverse exhibition hall, numerous networking events, and more. For those that were not able to attend this year, make sure you plan to attend next year in Anaheim, CA.

With this event comes the transition Council meeting of the year. It is the time when changes of leadership take place. The executive committee positions have been filled with the new members. Councilors that have expired terms are transitioned out and their replacements activated.

This year was the first year that the election of officers for our Society did not happen at the ANTEC Council meeting. We elected the new officers via remote, electronic balloting in advance of the ANTEC Council meeting. It seemed to work fairly well but the disadvantage is not being able to meet and discuss ideas with the candidates prior to casting votes. However, we were supplied with a fairly complete dossier and video recording of the candidate's statement.

This should be an exciting year from a leadership standpoint. As discussed in the last Councilor's Corner column, a governance task force (GTF) has proposed a new governance model for our Society. I had explained much of the new model and little has changed since that introduction. The acceptance of the new model will be voted on at the next Council meeting.

Another change that took place at the Council meeting was the introduction of a 3-year plan for the Society. One might ask why it took so long to look at more in depth, long term planning but suffice it to say, look ahead – not back. It is a good thing and should help with assessment of where we are going as a professional society. Some other things that will result from the 3-year planning effort will be:

- More input from Council, committees and task forces
- Develop talent inventory within SPE membership and Council
- Post volunteer opportunities within the Society

Update on membership of SPE International shows professional membership at approximately 12,000. In addition to that, we have about 2000 student members. Also, the new e-membership classification has been successful with about 6700 members. If we can convince a good percentage of the e-members to become full members, we can reverse the declining trend in our Society.

Other activities / announcements:

- Active task forces - - Governance Task Force (GTF), Awards, and Senior Advisory Board
- Young Professionals and Students - - Next Generation Advisory Board (NGAB)
- New Special Interest Group (SIG) - - Additive Manufacturing / 3D Printing
- New section in formation - - China
- New student chapters
  - o Western Michigan
  - o Mid-Michigan
  - o University of Tennessee

And my normal pitch - - please be active in your Section. We are always looking for new members and you can help by spreading the word to your colleagues. Also, we are always looking for help on our Board and committees at our Section level. If you are willing to help make our Section more effective for all our members, please contact any Board member on the back of this SPEcialist. Thank you.

WELCOME TO OUR NEW MEMBERS - Hamid Quraishi, Membership Chair

We are pleased to welcome our newest members of the Upper Midwest Section. As of June 30, 2016, our section has 309 active members! Tell your friends and co-workers about the SPE Upper Midwest Section to help us grow and check out our website, www.uppermidwestspe.org, and the national website, www.4spe.org, to know all that SPE and this section has to offer

New Member	Affiliation
Eric Meierdierks	NatureWorks, LLC
Ronald Langlie	BioPlastics Solutions LLC

SCIENCE CORNER

3D Printing Offers a Giant Step for Short Run Injection Molds

Gil Robinson, Senior Application Engineer - Vertical Solutions Business Unit, Stratasys

Abstract

Learn how 3D printed tools for injection molding can be used to save you time and money when creating short run prototypes from production grade plastics. This paper, will discuss the business rational behind this solution, show how some of our customers are using it and provide technical tips and tricks for success. We will also touch on a few of the future developments we see for this solution.

Introduction

Injection molding (IM) — the process of injecting plastic material into a mold cavity where it cools and hardens to the configuration of the cavity — is best used to mass- produce highly accurate, and often complex, three dimensional (3D) end-use parts and products. However, the development of molds for this process is often painstaking, highly expensive and time intensive.

Hard-tooling molds are usually made from tool steel with a CNC milling machine or via electrical discharge machining (EDM). When used in mass production, they can last for millions of cycles but cost hundreds of thousands of dollars. What's more, lead times to produce these molds are often measured in months rather than weeks or days. When tens of thousands of injection molded parts are needed, soft-tooling is an option. Made in aluminum, these molds are less expensive (typically $2,500 - $25,000) and faster to produce (2 - 6 weeks).

Unfortunately, the cost and time of tooling molds is often compounded by factors like design mistakes that require the mold be remade correctly or the need to create multiple iterations before the final part design and quality are achieved. It is with these issues in mind that manufacturers have begun to embrace the use of 3D printed molds to create functional IM prototypes.

PolyJet 3D Printed Molds: The Modern Alternative

PolyJet technology is an exclusive method of 3D printing offered by Objet™ 3D Printers from Stratasys® that gives companies the ability to build injection molds in-house, quickly and easily. PolyJet printing creates 3D objects by positioning successive layers of liquid photopolymer into desired configurations. The plastic is then cured solidified) with UV light. Once fully cured, molds can immediately be placed into IM equipment and used to create prototypes from the same material that is specified for use in the final product. These precision prototypes give manufacturers the ability to create realistic, finished- product examples that can then be used to gather true-to- life, performance data.

PolyJet injection molds are not intended to be replacements for soft or hard tools used in mid-and high volume production. Rather, they are intended to fill the gap between soft tool molds and 3D printed prototypes.

Key Points related to PolyJet molds

- The initial cost of creating a PolyJet mold is relatively low. However, PolyJet molds are best suited for runs ranging up to 100 parts depending on the type of thermoplastic used and mold complexity. As a result, the cost per part is medium.
- Building a PolyJet mold is relatively quick; a mold can be built within a few hours as compared to days or weeks to create traditional molds.
- In cases where design changes are required, a new iteration of the mold can be created in-house at minimal cost. This, combined with the speed of PolyJet 3D printing, allows designers and engineers greater design freedom.
- Molds created in Digital ABS material can be precisely built in 30 micron layers, with accuracy as high as 0.1 mm. These production features create a smooth surface finish so post-processing is not needed in most cases.
- Complex geometries, thin walls, and fine details can easily be programmed into the mold design. What's more, these molds cost no more to make than simpler molds.
- No pre-programming is needed to create PolyJet molds. Also, once the CAD design files are loaded, the 3D printing process can run without manual intervention.
- The manufacturing time to injection mold a part using a PolyJet mold is relatively low, although not as low as conventional molding.

SCIENCE CORNER continued on page 6

SCIENCE CORNER continued from page 6

Materials

Proper material selection is important for success when injection molding using PolyJet molds. Digital ABS is the best choice for printing IM molds; it combines strength and toughness together with high temperature resistance. Other PolyJet materials like rigid FullCure®720 and Vero also perform well as IM molds. However, when used to create parts with complex geometries, molds made from these materials will have shorter lives than those made with Digital ABS. The best materials for creating injection molded parts are those that have reasonable molding temperatures (< 570 °F / 300 °C) and good flow behavior. Ideal candidates are:

- Polyethylene (PE)
- Polypropylene (PP)
- Polystyrene (PS)
- Acrylonitrile Butadiene Styrene (ABS)
- Thermoplastic elastomer (TPE)
- Polyamide (PA)
- Polyoxymethylene or Acetal (POM)
- Polycarbonate-ABS blend (PC-ABS)
- Glass-filled polypropylene or glass-filled resin (G)

Plastics requiring processing temperatures of 250°C (480°F) and higher, or those that have high viscosity at their processing temperature, will shorten the life of the mold, and in some cases, the quality of the finished part.

Field Testing

Stratasys along with Nypro Healthcare, a global manufacturer of precision plastic products for the health care and packaging industries located in Bray, Ireland, conducted a series of tests to assess the performance of rapid prototyped cores and cavities with critical features that included:

- Gears
- Ratchets
- Interlocking legs
- Catch features

During one of the many tests conducted, sample ABS parts were injection molded into a single PolyJet mold made from Digital ABS. Parameters such as maximum pressure, cushion, and core and cavity temperatures were tracked.

Upon completion of the tests, the mold was deemed to be stable as indicated by a constant injection pressure and cushion, and that by using the recommended procedure for mold cooling, the temperature in the core and cavity did not exceed 58° C. What's more, the quality of the injection molded prototypes was deemed by Nypro to be "good."

Nypro offered the following analysis of the tests:

"It can be concluded that the injection molding trials were very successful… the process of printing cores and cavities can be considered an advantage in terms of time, initial functionality evaluations and reduced tooling cost."

1. Designing the Mold

- Increase draft angles as much as the part design allows. This will facilitate ejection and reduce stress on the tool as the part is ejected.
- Increase gate size to reduce shear stress.
- The gate should be located so that the melt entering the cavity will not impinge on small/thin features in the mold.
- Avoid using tunnel gates and point gates. Instead, use gates that reduce shear such as a sprue gate or edge gate.

2. Printing the Mold

To maximize the opportunities created by PolyJet 3D Printing, the following guidelines are recommended:

- Print in glossy mode to ensure smoothness.
- Orient the part in Objet Studio™ software so that the glossy surfaces are maximized.
- Orient the mold so that the flow of polymer is in the same direction as the print lines.

3. Finishing the Mold

A key benefit of PolyJet molds is that they can be designed, built and used within hours. Most will require little or no post-processing work, however further finishing may be needed if:

- The mold will be fitted to an ejection system.
- To ensure a tight fit between the ejector pins and the ejector pin holes, program the holes into the STL file but reduce their diameter by 0.2 - 0.3mm. Then, when the mold is cured, ream the holes to the exact final size.
- Inserts are being fitted onto a base.
- Extra smoothing of surfaces is needed.

4. Mounting

- Stand-alone molds — those that are not constrained to a base frame — can be mounted directly onto