Fall 2013 | No. 94

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
Ask the Expert: Hot Runners 9
Ask the Expert: Mold Maintenance 14
Getting to Know Your IMD Board Members: Dr. Larry Schmidt 18

This Month's Features:

What is SyncroSpeed? 19
| *Fred Pratt, CCS Technology Limited*
Case Study: In Injection Molding Facility Sludge Control 21
| *AMSA, Inc.*
IMD Best Paper: 23
Thermoplastic Polyurethane/Polyactic Acid Tissue Scaffold Fabrication by Twin Screw Extrusion and Microcellular Injection Molding
| *Hao-Yang Mi1 Xin Jing, Brianna Jacques, Lih-Sheng Turng, Xiang-Fang Peng*
IMD Board Minutes 33
IMD Leadership 36
IMD New Members 37
Membership Application 40
Publisher's Message/Sponsors 42

Chair's Message

Dear Members,

As I sat down to write this message I went back and looked at previous entries written by past chairs. I read one entry that I felt was particularly interesting from David Karpinski in regards to the future role China will play in the growth of SPE. In his message he highlights the influence that China has had on our industry. He also presented the thought that the ability to attract these new individuals to our Society will be critical for our future growth. At the last Injection Molding Division Board meeting this fact came to light again. While we have seen an increase in the number of papers submitted through our annual technical conference (ANTEC) from Asia, a breakdown of our membership revealed that less than 5% of the Injection Molding Division's

Chair's Message Continued

membership consists of members from this region. This statistic highlights that we have only begun to scratch the surface for our Society's potential in these countries.

The Injection Molding Division is attempting to take a proactive approach for expanding our influence in this area by helping organize a Medical TOPCON in Shanghai that will take place in December of this year (http://www.4spe.org/events/technical-groups/spe-medical-plastics-topcon-china-call-papers). We have seen a very strong response and expect a great conference. I would like to thank the board members who have put a lot of time and effort into putting this conference together. As a society that prides itself on remaining technical and rising above the politics that can often creep in, I believe this conference could be the beginning of a great future for our Society.

We also would love to hear how you feel the society could better serve you and your colleagues. Please feel free to email any comments to me at imdchair@gmail.com.

Thanks and have a nice day.

Best Regards,

Erik Foltz
Chair, IMD Board of Directors

Industry Events Calendar

Click the show links for more information on these events!

December 2013

11-12: SPE China Plastics Conference-Injection Molding 2013

Shanghai Marriott City Centre
www.4spe.org

January 2014

21-22: ANTEC® Dubai 2014

JW Marriott Hotel Dubai
www.4spe.org

February 2014

23-26: 2014 SPE International Polyolefins Conference "The Polyolefins Renaissance"
Hilton Houston North Hotel
www.4spe.org

24 - 26 : SPE Thermoset Conference 2014
Loews Ventana Canyon Resort
www.4spe.org

March 2014

11-13: Extrusion 2014 "Continuous Compounding"

Case Western Reserve University
www.4spe.org

12-14: GPEC 2014
Orlando, FL
www.4spe.org

25-26: Successful Plastic Part Design: The Fundamentals Revealed!
Gurnee, IL
www.4spe.org

April 2014

28-30: ANTEC® 2014
Las Vegas, NV
www.4spe.org

June 2014

11-12: Amerimold 2013
Novi, MI
http://www.amerimoldexpo.com/zones/general-info

Webinars

Top 11 Things Every Molder Should Know About a Molding Job (FREE!)

Injection Molding Troubleshooting: Short Shots & Weldlines (FREE!)

Injection Molding Troubleshooting: Flash & Burn Marks (FREE!)

Modern Injection Molding Machine Design and Software Concepts to Drive Energy and Process Efficiency
Thursday, December 5, 2013 2:00 PM - 3:00 PM EST **(FREE!)**

Hot Melt Granulation – Tips on How to Properly Size and Select aTrouble-Free Granulation System for Hot Plastic
This is an archived webinar you can view at anytime

Analysis Of Extrusion And Coextrusion Problems With Simulation
This is an archived webinar you can view at anytime

Improve Efficiency and Speed with Hydraulic Locking Core Pull Cylinders
This is an archived webinar you can view at anytime

Call for Trainers

The Society of Plastic Engineers Injection Molding Division is searching for trainers in the injection molding industry.

We would like to help promote training opportunities within our membership. If you are interested in training please submit the following:

- **Up to a 30 minute video showing your teaching style/method**
- **Description of topics covered**
- **Description of your teaching style**

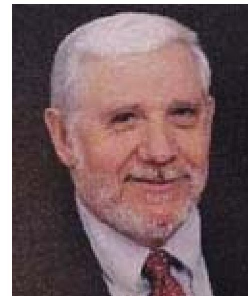
For more information contact:
Jeremy Dworshak
SPE IMD Board Member

763.767.7096
jdworshak@steinwall.com

Ask the Experts: Bob Dealey

Injection Molding Question From Mario Gonzalez:

We are having an issue with servo motors on a Nissei 190 FNX 50 A, injection molding machine.



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: **We are having an issue with servo motors on a Nissei 190 FNX 50 A, injection molding machine. Over the last three weeks we've burned out three servo motors. The machine has two servos motors, the main which runs the hydraulics for the clamp and injection unit and is in operation when those functions are called for. A secondary servo runs on demand, typically on screw recovery, but sometimes on injection.**

Two primaries and one secondary servo motor have failed. All three units appear that the magnets on the rotor have melted and disintegrated. We know that the servo temperature reaches 100° C, well above the typical operational temperature.

What can we do to resolve the issue?

A: Obviously, something is causing the servos to run hot. We need to identify and correct that for a final solution. Is it possible to install an Amp meter to measure current draw and document that to machine function?

For a quick, but temporary fix, I recommend that an aluminum plate be made to circulate water through the plate to cool the servos. Attach the plate to the cooling fin area of the servos and circulate water from either the machine hydraulic cooling exit or mold manifold with a water temperature of about 50° C.

A less attractive option is to induce air flow with a fan onto the servo air fins to help cool the motors. While air is not a great conductor of heat, if you can reduce the operating temperature to around 50°-60° C you will greatly extend the servo life.

Can you please provide more information regarding your process, the type of mold, plastics material, overall cycle, injection pressure and injection speed and number of cavities you are running?

Ask the Experts: Bob Dealey Continued

Response:

We are running a 32 cavity hot runner cap mold with polypropylene (three different colors) using about two-thirds of barrel capacity on about a 15 second cycle. We are transferring from first stage on ram position, with about a 2.5 second injection time, using full injection pressure and about 90% velocity on that stage. We checked for amp draw at the servo controller and we get a huge spike toward the end of first stage injection and a secondary spike on start of screw rotation. Placing a fan on the servos has reduced the operating temperature to about 82° C.

Answer to the Response:

I believe that a large contributor to the heat buildup in the servos is a result of using position to make the transfer out of high pressure and velocity on the first injection stage. Assuming that you pick a transfer position of 5-MM from screw bottom and want to fill the parts the typical 95 to 99% full before transferring out to a lower pressure and one of the 32 cavities fails to fill (blocked off, gate frozen, part sticks in cavity or any other reason), then the screw cannot make the transfer position. This creates a condition where the controls call for full current and exerts an extremely high load on the servos. The load remains until the injection timer times out.

An approach to transfer out of first stage on pressure could be a better option over transfer by position, as we are trying to fill the parts in this stage. If possible install a transducer in the melt stream to measure injection pressure. When the selected pressure point is reached, transfer out of first stage will occur. This will compensate if one or more cavities are not eligible to fill, position will never make this compensation.

So machine controllers will allow you to utilize injection pressure to make the transfer. It may make sense to add a slight screw recovery delay after injection to insure screw rotation is not working against any injection pressure. A couple of tenths of a second should be all that is required. I hope this resolves the servo burn out issue.

Plastic Engineering & Technical Services, Inc.

P.E.T.S. INTRODUCES

ENGINEERED CONTROL *AT AN AFFORDABLE PRICE.*

Plastic Engineering & Technical Service (P.E.T.S.)
Next Generation of Hot Runner Temperature Controlled Technology
Delivers a new level of processing, at an affordable price.

The PHRS TEMPERATURE CONTROLLER is a PID controlled instrument, specifically designed for the hot runner plastic injection molding industry. The controller is self adjusting and capable of maintaining a very high degree of accuracy over a wide range of operating conditions.

Each PHRS TEMPERATURE CONTROLLER has user friendly features that help the molder maintain superior part quality and provide a larger processing window.

STANDARD FEATURES:

- **J or K Type TC'S**
- **20 Amps per zone**
- **°F or °C temperature**
- **Available up to 48 zones**
- Automatic internal switching upon detecting a thermocouple reverse condition, which lets the zone remain in operation.
- Automatic shut-off when a shorted or mis-wired thermocouple is found.
- Automatic switch to manual mode when an open thermocouple is detected.
- Full PID Control
- Warm-up Cycle
- High/low temperature alarm indicator when measured temperature is +/- 40 degrees F from set point.
- 3 digit, 7 segment LED actual and set point temperature readout
- 2-digit, 7 segment LED heater current amp draw readout
- Automatic/manual control modes
- Automatic save of preset system configuration at shutdown and automatic reload of last used configuration at start-up.

Plastic Engineering & Technical Services, Inc.

Call today for special pricing!

Plastic Engineering & Technical Services Inc. (P.E.T.S.)
4141 Luella Lane,
Auburn Hills, MI 48326
+1 248.373.0800
sales@petsinc.net
www.petsinc.net

P.E.T.S. Hotrunner (Shenzhen) Co. Ltd.
Shenzhen, China
帕兹热流道科技(深圳)有限公司
电话: (86) 0755-2910 9973

P.E.T.S. Europe Ltd
Unit 7, Beaver Industrial Estates
Southmoor Lane
Havant, Hampshire, P09 1JW
+44 (0) 23-9439-2411
sales@petsinc.net

P.E.T.S. Hotrunner (Mexico)
Blvd Luis D. Colosio 1979-2
Col. San Patrico
Saltillo Coah, Mexico
011 52 844 1808 1381
salesmx@petsinc.net

P.E.T.S. Hong Kong
P.E.T.S. International Systems
Unit 505
Wing On House
71 Des Voeux Rd. Central,
HK

Hot Runner Questions

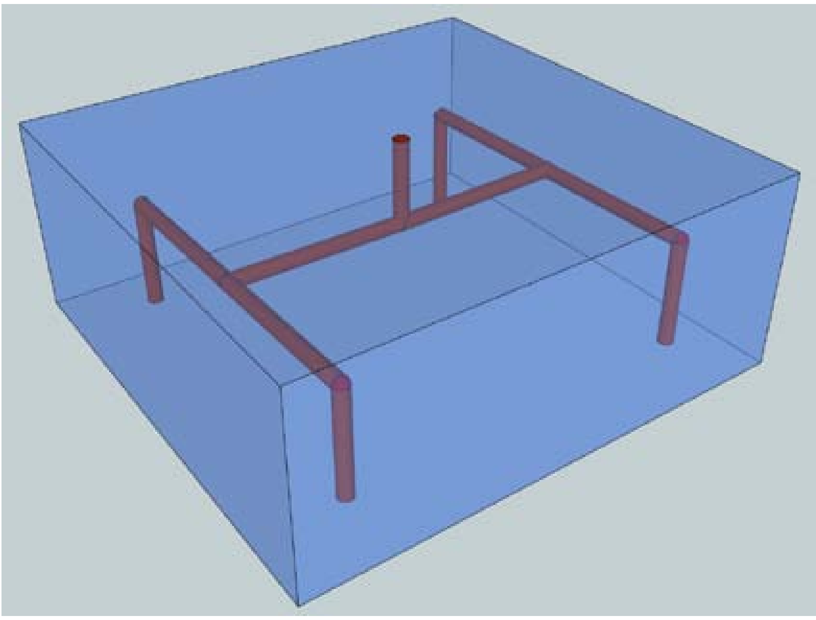
The purpose of this column is to provide valid information concerning hot runner technology. We invite you to submit questions or comments to our hot runner expert, Terry L. Schwenk. Terry has over 38 years of processing and hot runner experience. He is currently employed with EWIKON Molding Technologies and can be reached by mailing: terry.schwenk@ewikonusa.com.

Q: How do I test the balance of my hot runner system?

A: I am going to answer this question by first stating that most perceived hot runner imbalances are more related to tooling and processing than to hot the runner system itself, and the information I will disclose here will assist you in identifying root causes of the imbalance. You can also find an article that was published several years ago based on case studies that further discuss these concerns. (http://www.moldmakingtechnology.com/articles/hot-runners-help-the-balancing-process). There are also an abundance of articles on tooling and hot runner balancing. I tend to stick with factual information verses theories or opinions.

Short shot analysis has been used to identify filling imbalances and usually puts emphases solely on the hot runner as the culprit, ignoring other possibilities. Let's discuss what imbalances that can be related to the hot runner. The hot runner is nothing more than a heated vessel for which the hot resin is pushed through. So we first want the system to have a consistent and even distribution of the flow bores throughout the system. This is usually accomplished by dealing with an even number of cavities, (ie, 2, 4, 8, 16, 32) and numbers divisible by 2. Other possible combinations are 6, 12, 24, 48. (**Figure 1)** These combinations allow for easy geometrical balancing. A geometrical system by its very nature cannot be imbalanced as long as the flow bore diameters and lengths are maintained. Now what other influences can cause the plastics not to flow evenly through the system under pressure? Heat, is one item that would have an influence. The hot runner is a heated vessel. The distribution of heat needs to be even, as not to have hot or cold areas that would influence the melt flows through the

Figure 1



Ask the Experts: Terry L. Schwenk Continued

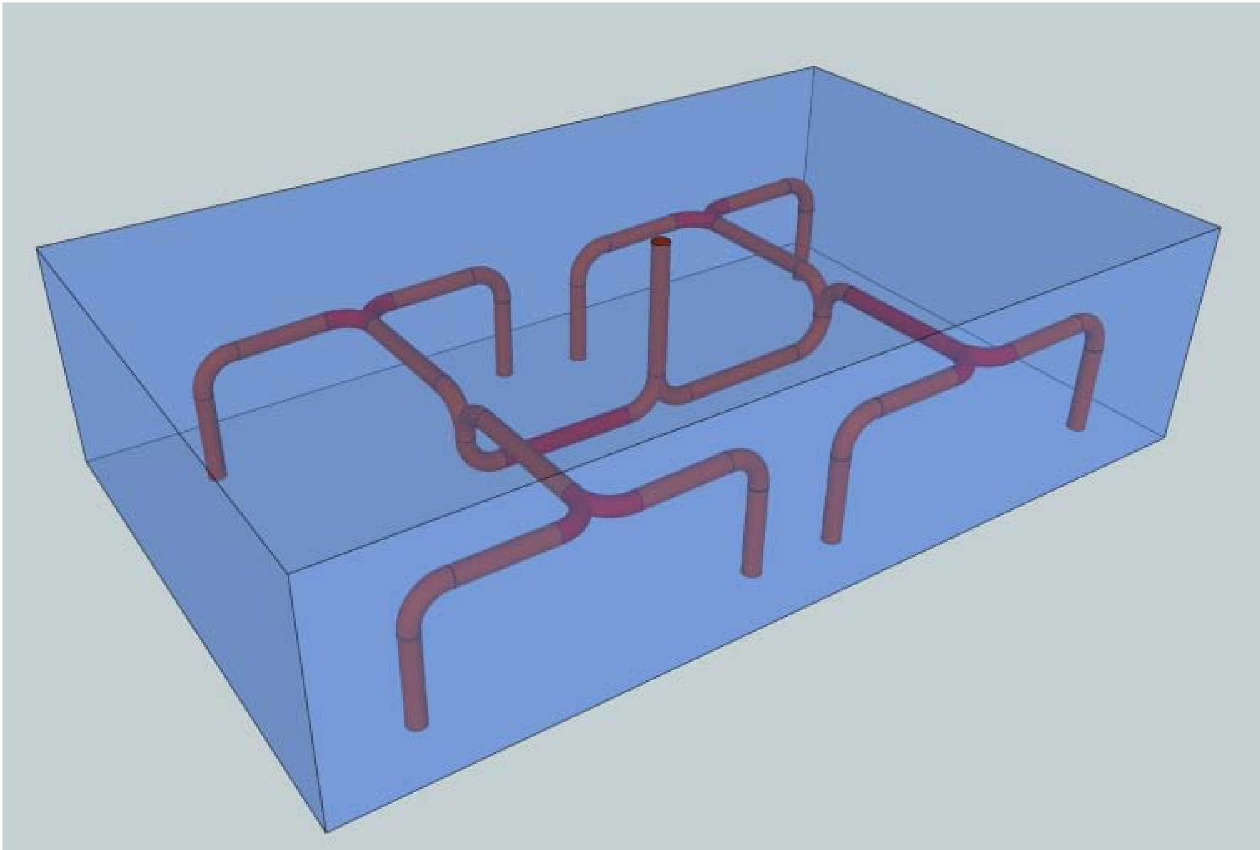


Figure 2

hot runner orifices. Since the process involves thermoplastics, we should review the types of materials being processed through the hot runner system. Some resins are more thermally sensitive than other resins. Amorphous materials generally are more susceptible to heat or shear influences than crystalline or semi-crystalline resins as it relates to resin viscosity and therefore will exhibit greater imbalances due to these influences. But don't overlook the injection unit. The hot runner cannot correct heat imbalances in the melt from the injection molding machine. Don't expect the hot runner system to heat or cool the material. The hot runner heats only need to maintain the heat in the resin created by the injection molding machine. For overall processing performance it is imperative that a homogenous melt be delivered to the hot runner. Any melt inconsistencies will be multiplied through the hot runner. Let's say the melt coming out of the injection unit is 450° F and the set point of the hot runner is set at 500° F and you have a cycle time of 15 seconds. Typically the hot runner will have 3-4 shots in the system. First, the hot runner will not induce 50 degrees of temperature within 60 seconds. Second, by introducing cold resin into the hot runner system, in essence you are creating a heat sink where the resin is continually trying to cool the runner system forcing the hot runner to be continuously under load. This could result in heat inconsistencies in the hot runner system and melt. I cannot tell you how many times I have walked into a molding company to find the hot runner heats set 100 degrees Fahrenheit above the machine barrel temperature and the processor could not understand why they couldn't make a good part. It is unreasonable to expect the hot runner to heat the resin an additional 100 degrees in a short period of time. But this seems to be common practice. Other items in the molding machine

Ask the Experts: Terry L. Schwenk Continued

are the use of shut off nozzles and filtering devices. These items can introduce shear and pressure drop imbalances that will propagate and be carried through the hot runner system. Remember plastic resin flows laminar and any shear effects will be carried through the system an end up in the part. One of the areas that has gained a lot of attention in the last few years is flow bias related to shear imbalances within geometrical cold runners. This is a proven phenomenon and occurs not only in the runners but also in the molded part itself. Where ever the resin is forced to make a directional change, there is the potential for shear to occur. So it is important to keep directional transitions as smooth as possible. Some hot runner companies use flow elements to create a smooth transition in conjunction with level changes to reduce shear and counter act its bias. (**Figure 2**)

Short shot analysis can be used to identify filling imbalances, however in order to properly identify the hot runner as the part of the imbalance two short shot studies are essential. One at 10% of fill, and one at 90% of fill. The 10% fill is to identify that all gates are opening simultaneously. If all gates open at same time, great. If not, some minor adjustments can be made in reference to nozzle tip temperature in order to get all gates opening simultaneously. However this doesn't mean the hot runner has a deficiency. The imbalance could be related to gate temperature, gate size, gate finish and gate land. All of which will have an effect on when the gates open. Being able to adjust nozzle temperature to compensate for these deficiencies is a benefit of the hot runner system. There are companies such as Priamus System Technologies which control gate opening uniformity through nozzle temperature adjustments in a closed loop system. Assuming all gates are opening simultaneously , having an imbalance at 90% fill would not necessarily be directly related to the hot runner system due to so many other influences having a direct effect on resin's resistance to flow. Such as gate size, gate land, uniform cavity wall section, uniform mold steel temperatures and venting, just to name a few. Trying to make adjustments in the hot runner for these items can be problematic, since you really only have control of nozzle temperature and this by design only controls the nozzle tip relating to when the gate will open and how quickly the gate freezes. Once flow begins the rate of flow to each cavity is dependent on even melt distribution of the hot runner relating to bore size and length, even heat distribution. The rest of the flow balance is related to uniform gate size, uniform gate land, uniform cavity wall section and cavity volume, uniform heat distribution of mold, uniform venting of all cavities.

I get asked quite often what are acceptable tolerance of gate size and steel wall sections. This depends on what you're willing to accept in part uniformity and fill imbalance. Common gate sizes for hot tip systems are around .028 inches. If the machining tolerance is plus or minus .0005 inches, right away you have a 1.7% variance in gate diameter, however plastic flows through a cross sectional volume. The cross sectional area variation is 7%. This is substantial, especially filling a moderate size part. This logic can also be applied to part wall sections. You have to understand that a .030 inch wall section doesn't mean you have a .030 inch flow path. Polypropylene material will have a .003 to .004 inch skin immediately when it comes in contact with the cold steel. This means the flow path is .022 to .024 inches. If your machining tolerance is .001 inch, that equates to approximately 5% change in flow path sections. When packing out a part these variations alone are huge because of the pressure drop influence at these different flow sections.

You have to understand the hot runner has very little control over flow balance because of the dynamic nature of non-Newtonian plastic melt. Because plastic compresses when you have one gate opening sooner than another the pressure differential dictates the flow preference. This is one of the reasons for using a profiled injection to help dampen these effects. Setting a slow fill at the very beginning to ensure pressure equalization, resulting in all gates opening at the same time and then increasing the fill velocity to whatever you need to fill the part will help minimize initial fill imbalances with hot runner systems.

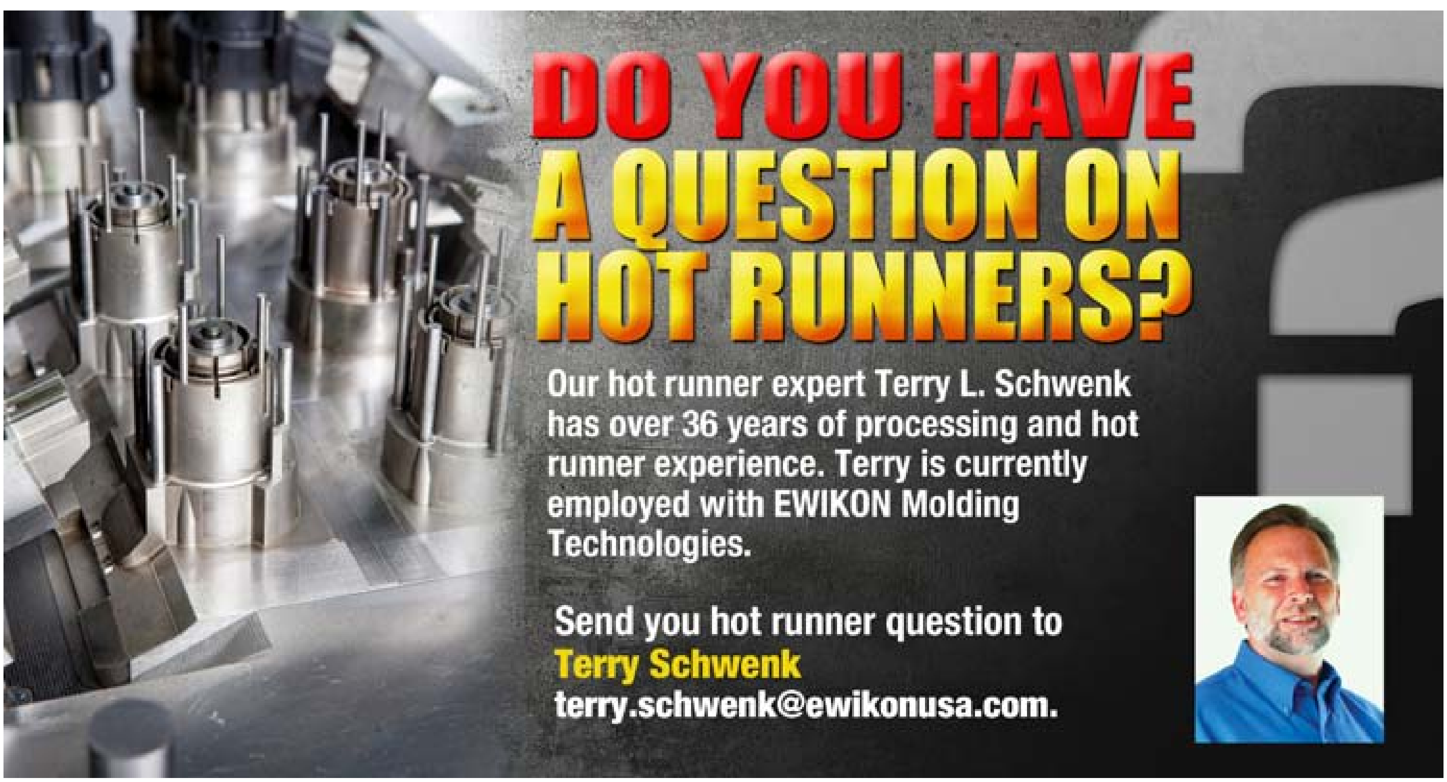
Ask the Experts: Terry L. Schwenk Continued

There are several exercises that can be performed to help identify where the flow imbalances occur. One item is to remove the cavity plate exposing the hot runner tips and purge through the system under normal filling. (CHECK WITH YOUR HOT RUNNER SUPPLIER TO MAKE SURE THIS WILL NOT POSE ANY ISSUES WITH THE HOT RUNNER). Collect the purging out of each nozzle and weigh the purging. You may want to repeat this a few times, recording the information. If your hot runner is correctly balanced, you can expect not to see more then 3% variation.

The interface of the molding machine nozzle orifice to the hot runner system melt entrance needs to be matched. If the molding nozzle orifice is smaller than the hot runner entrance the material will flow in the center of the hot runner causing shear imbalance and problems with color changes.

If you have high expectations on your mold filling balance, you need to be fully aware of all the influences revolving around balance fill, including the hot runner. However don't expect the hot runner to correct conditions out of its control. The hot runner system is only a distribution device for the molten plastic from the injection molding machine to the mold cavity. The hot runner can only adjust temperature of the hot runner transfer heat to the melt from the outside in. This means that filling imbalances can be caused by trying to heat the melt in the hot runner by operating the hot runner temperature too different than the melt, where the outer layer of the flow bore could be hotter or colder than the inner layer.

You will be well served by taking the time to properly analyze exactly where the cavity fill imbalances occur and make the adjustments needed.



2013-2014

Rotational Molding
Product Design Competition

Call for Entries

Engineering and Design Students | **Professional Product Designers**

Be recognized as a Rising Star in the field of rotational molding product design. Just by entering, your work will gain international exposure to top companies, employers, and prospective clients.

It can take a lifetime of work to gain recognition in your field.

Jump start this process and become known across the industry as an Award-Winning Designer.

Student Prizes

2-D Drawing or CAD Solid Model

1st Place $500 plus TopCon* Hotel Accommodations and Presentation Slot

2nd Place $250 plus TopCon* Hotel Accommodations

Honorable Mentions (10) $150 plus TopCon* Hotel Accommodations

Professional Prizes

Product must be in the market

1st Place $3,000 plus Presentation Slot at TopCon*

2nd Place $1,500

Honorable Mentions (3) $1,000

**SPE Rotational Molding Division TopCon June 1–4, 2014*

Judging Criteria

Originality ★ Process-ability ★ Growth Potential
Beauty and Visual Appeal ★ Tool Building Compatibility
Use of Appropriate Materials ★ Sustainability ★ Environmental Impact

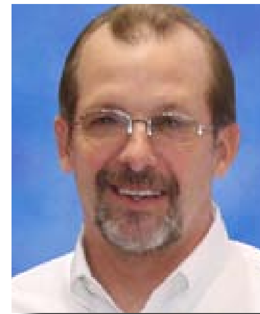
Entry Deadline
February 6, 2014
(No entry fee required)

Contact: Fred Shockey, Product Design Committee Chairman fred@winsellinc.com 330-289-3449

The 2013-2014 Rotational Molding Product Design Competition is a program of the Society of Plastics Engineers® Rotational Molding Division.

Part 2

TheRun/Repair Cycle of Data



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

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

Q: In your previous column, you addressed some important points about mold data collection, whose job it is to do it and how it helps to improve mold performance and maintenance efficiency. Can you further explain what kind of data should be collected, and how it should be used and managed?

A: In the typical run repair cycle, there are several contributors of information that will dictate the type of repair a mold will need or the task that needs to be performed. Understanding all the different performance and running characteristics of a mold takes contributions from not just the repair technician that works on the tool, but also from the process tech who sets and starts it, those who inspect the parts and occasionally look at random shots, and the tech who stops the mold as well as responsible tooling engineers, Q/A technicians, etc. Collecting the right data takes a village, and this is where the problems usually begin because not everyone in the village will necessarily be on board with their part in this data collection collaboration.

First Requirement is Data Collection

Getting the right folks to do their part in this necessary step to keeping molds running reliably and to designed specifications can be a daunting task and has been the downfall of many maintenance improvement initiatives.

The reason is, few people like to spend time at a computer entering information. It can be a tedious, confusing task that, even if the data is providing valuable information that guides us in our business decisions, is just not fun to anyone but those who are "wired" that way.

There are two major factors that dictate the level of proficiency and reliability that a company reaches in their data collection and usage culture:

• ***The method in which data is entered into a system***

There are only three methods by which to enter/collect data. First is the old fashioned — and most popular — way of just typing or writ-

Ask the Experts: Steve Johnson Continued

ing down information in a journal type format, much the way one would keep a diary. It's one big text field with random, generalized thoughts using unstandardized terms. It's a loose, valueless method that is one step better than nothing at all. Excel, log books, notebooks and the majority of all maintenance systems collect data in this fashion.

Second is "live" data being entered automatically when an electronic switch is triggered, like the opening or closing of a mold or press door. This type of data consists of dates, times, quantities etc., that still needs a human to decipher and clarify it or you just end up with a bunch of dates and times with no supporting information about what happened or what corrective action or task was applied.

The third — and best — is when the data consists of standard terms that fit the job and are selected, or "picked", from a list of possibilities. This type data has distinct advantages over the other two as it can be sorted, categorized, counted and pointed to various items that can be highlighted and targeted for frequency or cost reductions.

Maintenance data collection must be interactive to make sense. There is just no other means to do it accurately until we can plug a USB into the backs of our brains.

• ***The method by which the collected data is "fed" back to the interested users***

As mentioned, journal type data provides no "direction" one should head, only "after the fact" info that is much too difficult to use. Live data is also too ambiguous or incomplete to base accurate decisions on.

Mold performance and maintenance data is extremely valuable to a host of company departments when presented in a job-related format. Here are the top 10 data users of mold maintenance and mold performance data (P&M) and a few of the questions they need answers to:

OEMs of Molds

These folks want to know if they are getting their money's worth from their mold, and in today's molding environment, if their molds are being taken care of properly and at the right frequencies. They need big picture data concerning mold P&M costs and they want these costs broken down by products, type, host company, etc.

Ask the Experts: Steve Johnson Continued

Custom Molding Shop Owners, Plant Managers or CEOs

This group needs data to show the above mentioned OEMs that their molds are being taken care of properly, and they also need to make a profit. They need to know where the maintenance money is going so they can make better decisions about customers, mold types, production issues and scheduling runs.

Tooling Engineers

This group needs more detailed data about specific mold issues that help or hinder mold performance. Most are charged with improving performance and this cannot be done without first understanding what issues prevent molds from running as designed or required.

Mold Builders

All mold builders want to build better molds. It is a great advantage for them to know exactly how their molds perform so they can better serve their customers.

Mold Design Engineers

All mold designers want to design better molds. For them it's also about mold performance relevant to the type of product, what works and what doesn't.

Quality Managers/Supervisors

Those responsible for part quality need data relating to defects, production periods and other data they can use to reduce the number of bad parts going out the door and into customers hands. Standardizing defect information and terminology so that all in a molding company are on the same page can greatly reduce customer issues or returned/recalled products.

Toolroom Managers/Supervisors

"Efficiently Produce Quality Parts on Time" is a goal that can only be achieved when P&M data is collected and continuously reviewed to target poor running molds and inaccurate corrective actions. TR supervisors need KPI data that reflects how effectively their techs repair molds and where and what they are spending labor hours doing. It's the only way to manage a repair shop.

Repair Technicians

These guys need to know about every defect and corrective action made to a mold and how effective it was. They need to understand the P&M characteristics of every mold in the house to become better troubleshooters versus being just tooling replacers. Defect trends and patterns using mold position analysis data is critical to finding root causes for everything that keeps a mold on the bench versus in the press running 100%.

Process Technicians

Process techs should never be left out of the maintenance loop as they are the ones responsible for starting and running molds. Good decision making on their part is often based on what was done to a mold and the expected outcome. It makes no sense to keep them in the dark as they, too, need to know a mold's characteristics when certain process parameters are applied.

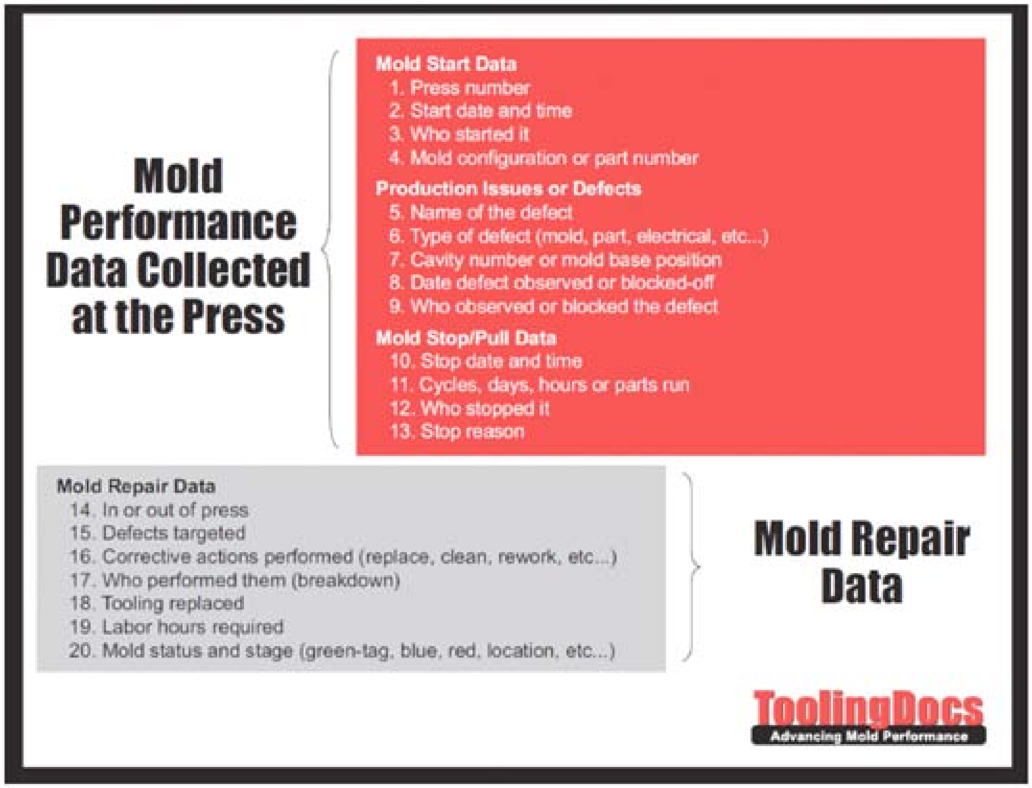
Ask the Experts: Steve Johnson Continued

Production Managers/ Supervisors

This group needs to know what molds are dependable and have a history of performing as needed when preparing for a run. Keeping presses running and parts shipped depend upon accurate scheduling and reliable molds, or customers and management alike will not be happy.

Shown in **Chart 1** are 20 pieces of data that, when related appropriately, will provide the necessary information for all of the above job descriptions to accurately and efficiently make good decisions concerning mold performance. They will also have a direct bearing on maintenance improvements that will keep companies moving forward. When it comes to P&M data, tracking the past will secure our future.

Chart 1



***Steve Johnson** ToolingDocs LLC, and owner of MoldTrax.*

Getting to Know Your IMD Board Members
Dr. Larry Schmidt

Dr. Larry Schmidt has had a long and distinguished career in the plastics industry. He began his career in plastics as an Associate Staff Engineer at General Electric Corporate Research & Development Center in 1967 after receiving his Ph.D in Chemical Engineering from The University of Colorado - Boulder. Over the 22 years he worked at General Electric, he focused his industrial research in the areas of precision injection molding, continuous melt polymerization in extruder-reactors, extrusion (single and twin-screw configuration), thermoforming and rheological behavior of viscoelastic materials. He spent the last 11 years of his career at General Electric as the manager of the polymer engineering programs, leaving with five US patents relating to plastic processing. After GE, Larry founded LR Schmidt Associates in 1992, a plastics consulting firm specializing in advanced process designs and product concept.

Through his work at LR Schmidt Associates, Larry has given over 50 presentations on plastic processing and troubleshooting processing issues through the understanding of viscoelasticity. His work in this area has been revolutionary and integral to modern-day injection molding simulation and has helped pushed the industry forward.

Larry has been an active member of the Society of Plastics Engineers (SPE) for over 35 years. He has been active at the national level, in both the Injection Molding Division (1998-2013) and the Extrusion Division (1978-1993), where he served as Chair and Councilor. Because of his dedicated service to SPE he has been awarded the prestigious Honored Service Member and is a Fellow for SPE. Larry continues to serve on the Injection Molding Division Board as an emeritus member.

When Larry is not working he spends the majority of his free time renovating/restoring his 200 year-old house in Schenectady's Stockade Historic District with his wife Jennifer. It has been a labor of love with many exciting surprises, along with numerous frustrating moments. In 1996 the Schenectady Heritage Foundation presented a Preservation Award to Larry and Jennifer" in recognition of outstanding contribution to historic preservation." Larry has also been active with the Stockade Villagers Art Show which recently celebrated its 62nd annual show. He has served many years on the Board, and as Treasurer and Show Co-Chair with Jennifer in 1978. Larry and Jennifer spend the rest of their free time visiting their two daughters in California and Germany.

What is SyncroSpeed?

SyncroSpeed 250 HP single-motor system installed on a Husky 1100t

SyncroSpeed is a retrofit control system installed on injection molding machines (IMMs); its purpose is to improve the machine's operating energy efficiency. The system includes a variable frequency drive (VFD or inverter) which is used to regulate the speed of the pump motors. Controlled in the correct way, reducing motor speed can result in a considerable reduction in motor power consumption while at the same time maintaining full productivity (cycle time) and process consistency (part quality); this is what SyncroSpeed does.

All conventional hydraulic IMMs are powered by induction motors, selected for their ruggedness, low purchase cost, and low ongoing maintenance. These motors run at a fixed speed, but most of the time through the cycle of the machine not all the oil from the pumps is needed. Machine manufacturers use various techniques to manage the over-production of oil and to return the excess volumes back to the oil reservoir, all with varying degrees of inefficiency. A far more efficient method would be to continuously regulate the speed of the motor, so the pumps produce just the right volume of oil that is needed at any instant; this is achieved by SyncroSpeed.

SyncroSpeed comprises electronics hardware and control software components. All hardware is bought from recognized leading global suppliers and is assembled in an industrial steel enclosure. The software supports unique and highly sophisticated elements of control, developed through the needs and experiences of working with most of the popular makes and models of injection molding machines around the world.

Feature: SyncroSpeed Continued

Results vary according to machine brand & model, the form of the molded component, and the material being processed. Typical energy savings range 25%-45%, with some exceptional results exceeding 70%. In practical terms, SyncroSpeed will find and deliver some energy saving on any hydraulic press. When the bottom line is all about reducing energy and molding costs ... SyncroSpeed is the premium tool to make those reductions and is best deployed on larger motors that are planned to be operating for most hours of the year.

SyncroSpeed 135 HP 2-motor system installed on a Cincinnati 725t

Ruggedness and reliability are underpinned by robust design and build, adherence to prevailing standards and codes, together with a high specification of all key components. The control and physical configuration offers four escalating levels of system by-pass to rapidly manage any minor or major event that may affect production capability. The remote monitoring system links SyncroSpeed installations with the CCS bureau in England to support realtime monitoring, data-logging, program updates and troubleshooting.

The SyncroSpeed team offers a great deal of know-how and experience. We are ready to assess your stock of injection molding machines, analyse the savings potential, and offer an effective program of attack on the wasted energy associated with your machines.

Fred Pratt, Energy Efficiency Division, CCS Technology Limited

For more information contact Robert Knaster, Plastic Metal USA Ltd. at (914) 582-1848 or e-mail robert.knaster@syncrospeed.com

www.plasticmetalusa.com

DTEA II™

Case Study:
In Injection Molding Facility Sludge Control

Problem — Failure Rate

A Midwest plastic injection molding company had been treating their cooling tower water with good success over several years. Recently, the plant purchased a new packaged chiller to produce low temperature chill water for a specific mold application and used the existing cooling tower water to cool the condenser section.

After only a few weeks, the chiller efficiency dropped to the point that it could not maintain chill water temperature, and would fail due to high head pressure, attributed to surface fouling. The existing water treatment program failed to keep the surfaces clean of fouling. Chiller failure continued. The chiller issues caused significant production problems, including increased parts failure rate, product delays, and maintenance costs. In addition, chiller surfaces were significantly fouled as shown, and thus, production rate was further impacted.

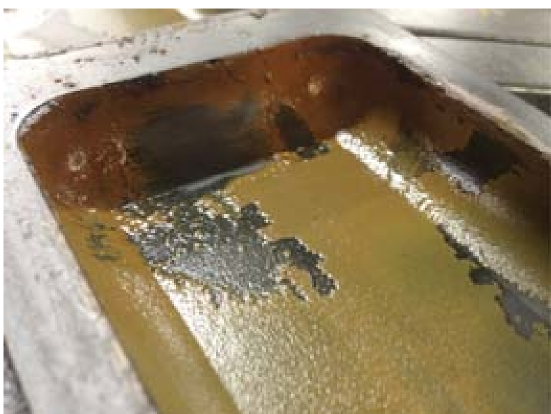


Image 1: Slime coated chiller surfaces

Cause of Problem — Biofouling

It was determined that the cause of fouling was related to a microbial produced coating (biofilm) on the heat exchange surfaces. Biofilm is created by bacteria so they can attach to surfaces, and reproduce more efficiently than if freely floating (planktonic). This "slime" (biofilm) prevents or limits biocides' ability to kill the bacteria. A microscopic layer of slime reduces heat transfer rates which results in loss of process temperature control. By the time such layers are visible, the problem is very severe.

Although studies on the bulk water showed very few microorganisms present, it was clear that significant slime remained on the heat transfer surfaces. The current biocide program was effective in the bulk water, but was not effective in controlling surface fouling.

Solution — A Successful Biofilm Control Program (DTEA II™ plus biocide)

Immediately after cleaning the condenser, DTEA II™ (trademark of AMSA, Inc.), an effective penetrating agent, dispersant, and corrosion inhibitor, was used at dosage levels of 12 ppm (active) once per week. One hour after the addition of DTEA II™, the biocide was added (few ppm active).

Shortly after the addition of DTEA II™, a brownish foamy slurry developed. Slurry formation is related to the cleaning action and is proportional to the amount of deposits removed. Once the surface is clean, slurry formation stops.

DTEA II™, used on a consistent basis (maintenance mode vs cleanout mode), cleans surfaces and reduces the amount of biocide needed.

Image 2: DTEA II™ tested chiller surfaces free from slime

Results — DTEA II™ Program Effectively Cleaned the Surfaces

Prior to the DTEA II™ program, the chiller could stay on line no more than about 7 weeks before shutdown and cleaning. Using DTEA II™, there has been no downtime due to condenser fouling. After several months, inspection showed the surface to be absolutely clean with no indication of organic deposits.

DTEA II™

Biofilm Control Programs

Need More than Biocides!

The Ultimate

Biofilm Control Program

Why not use DTEA II as part of your Biofilm Control Program?

In a biofilm control program, the biocide provides microbial kill and DTEA II provides the dispersion, penetrant aid, and cleaning function.

Call Us Today!

To find out how **DTEA II** can enhance your program.

888 739-0377

AMSA, Inc.®

AMSA, Inc.™
4714 S. Garfield Rd. • Auburn, Michigan, USA • 48611
Tel: (989) 662-0377 Fax: (989) 662-6461
sales@amsainc.com
www.amsainc.com

AMSA, Inc. manufactures DTEA II™ Chemistry.
AMSA, Inc. exclusively serves industrial water treatment service companies.

IMD Best Paper

Hao-Yang Mi[1,2], Xin Jing[1,2], Brianna Jacques[3], Lih-Sheng Turng[2*], Xiang-Fang Peng[1*]
[1]National Engineer Research Center of Novel Equipment for Polymer Processing
South China University of Technology, Guangzhou, 510640, China
[2]Polymer Engineering Center, University of Wisconsin–Madison, Madison, WI 53706, USA
[3]Department of Biology, University of Wisconsin–River Falls, River Falls, WI 54022, USA

Thermoplastic Polyurethane/Polyactic Acid Tissue Scaffold Fabrication by Twin Screw Extrusion and Microcellular Injection Molding

Polylactic acid (PLA) and thermoplastic polyurethane (TPU) are two kinds of biocompatible and biodegradable polymers that can be used in biomedical applications. They possess rigid and flexible mechanical properties. The TPU/PLA blend tissue scaffolds at different ratios were fabricated via twin screw extrusion and micro-cellular injection molding techniques (a. k. a. MuCell) for the first time. Multiple test methods were used in this study. Fourier transform infrared spectroscopy (FTIR) verified the presence of the two components in the blends. Differential scanning calorimetry (DSC) and dynamic mechanical analysis (DMA) confirmed the immiscibility between TPU and PLA. Scanning electron microscopy (SEM) images affirmed that the PLA was dispersed as spheres or islands inside the TPU matrix, and that the phase morphology further influenced the surface rough-ness of cells. The blends exhibited a wide range of mechanical properties that cover most human tissue requirements. It was found from DMA and viscosity tests that 25% PLA significantly reinforces the blends at low temperatures or deformation frequencies.

Introduction

Tissue engineering is aimed at the regeneration of malfunctioning tissues and the fabrication of whole or partial artificial organs for transplantation. It is attracting more and more attention since it was reported by Langer [1]. Tissue scaffolds, which act as extracellular matrices (ECM) for cell adhesion, proliferation, migration, and differentiation, play a pivotal role in tissue engineering [2]. The main challenge for tissue engineered scaffolds is to design and fabricate three-dimensional (3D), highly porous scaffolds capable of fulfilling the

IMD Best Paper Continued

requirements of the target tissue. The optimal pore size for tissue regenera-tion depends on the type of tissue [3]. Mechanical pro-perties and surface chemistry are two other important factors which influence the usefulness of the scaffold, as well as cell adhesion and migration. Various materials provide different mechanical properties. Likewise, rough scaffold surfaces can help to improve cell adhesion [4, 5].

PLA is the most popular biocompatible and bio-degradable polymer used. It has also been widely used in the tissue scaffold field, for applications including bone regeneration [6], blood vessel scaffolds [7], and cartilage scaffolds [8]. However, PLA alone can usually only be used in hard tissue scaffolds due to its naturally high strength and brittleness. Recently, bioresorbable polyurethane (PU) scaffolds have been attracting considerable attention as a potential material for tissue engineering [9]. TPU is a class of PU that has been widely employed in medical applications due to its flexibility and excellent abrasion and tear resistance [10]. Therefore, a scaffold combining PLA and TPU at various ratios would yield multiple desirable properties suitable for different tissue applications.

Several methods have been used to fabricate tissue scaffolds including solvent casting/particle leaching, thermally induced phase separation, electrospinning, rapid prototyping, batch foaming, and microcellular injection molding [11-15]. Among them, microcellular injection molding is a relatively new method which is organic-solvent free and has the potential to mass produce tissue scaffolds. In this paper, PLA and TPU were melt blended at a variety of ratios and fabricated into scaffolds via microcellular injection molding technology. The miscibility, mechanical properties, foaming behavior, and rheology properties were investigated.

Experimental

Materials

TPU (Elastollan 1185A, BASF Ltd., USA) is an elastomer that provides flexibility to the blends. PLA (3001D, NatureWorks LLC., USA) was selected to improve the rigidity of the blends. Both TPU and PLA have close melt processing windows, thus allowing them to be combined effectively.

Scaffold Fabrication

TPU and PLA pellets were dried with a circulating air flow at 100°C for 3 hours prior to compounding. Materials with various formulations—including PLA, PLA75%, PLA50%, PLA25%, and TPU—were compounded with a twin-screw extruder (Leistritz ZSE 18 ANTEC® 2013 / 1635HPe) at 190°C (the die temperature) at 110 rad/s screw speed, followed by water cooling and granulation.

Table 1: Microcellular processing parameters.

Parameters	Value
Cooling Time	60s
Clamp Tonnage	200kN
Mold Temperature	23°C
CO_2 Content	4% wt.
Injection Volume	70% vol.
Injection Speed	20cm^3/s
Plasticizing Temperature	190°C
Back Pressure	6 MPa

The pre-blended granules were dried for 3 hours at 100°C to remove any moisture before being used for microcellular injection molding. The injection molding machine used was an Arburg Allrounder 320S equipped with a supercritical carbon dioxide supply system (MuCell® Trexel, Inc.). The processing parameters for the microcellular injection molding procedure are listed in **Table 1**. Both solid and foamed samples were produced.

Characterization

Fourier Transform Infrared Spectroscopy (FTIR)

FTIR measurements were carried out using a Bruker Tensor 27. The samples were analyzed in the absorbance mode in the range of 600 to 4000 cm^{-1}. Functionalities corresponding to each of the absorption bands were ana-lyzed.

Differential Scanning Calorimetry (DSC)

Thermal property measurements were performed on a DSC Q20 (TA Instruments). Samples were encapsulated in standard aluminum pans and covered with standard lids. Samples were heated to 220ºC at a heating rate of 10 ºC/min and held isothermal for 5 minutes to erase prior thermal history. They were then cooled to –80 ºC at 5°C/min and heated to 220°C again at 10 ºC/min. All tests were carried out under the protection of nitrogen.

Dynamic Mechanical Analysis (DMA)

Thermal dynamic properties of the samples were examined in single cantilever mode by a TA Instruments DMAQ 800. The samples were trimmed to 35.6 mm long by 12.8 mm wide by 3.2 mm thick. The tests were performed at a temperature range of –60°C to 150 ºC at a heating rate of 5°C/min with a frequency of 1 Hz. Liquid nitrogen was used to generate the low temperature and control the temperature during heating.

Scanning Electron Microscopy (SEM)

The phase morphology of the solid samples and, as well as the microstructure of the foamed samples, were evaluated using a Nikon JEOL Neoscope SEM with an accelerating voltage of 10 kV. All specimens were fro-

IMD Best Paper Continued

zen in liquid nitrogen and broken by two clamps in cross section at the bending center. SEM observations were performed after sputtering the samples with a thin film of gold for 40 seconds.

Mechanical Properties

Tensile tests of dog bone bars were performed on a universal mechanical testing machine (Instron 5967), according to the standard test method for tensile properties of plastics (ASTM D638). The tests were performed at ambient temperature (23°C) with a cross-head speed of 50 mm/min. A 600% tensile strain was set as the termination requirement of the test due to limitations associated with the instrument. The same instrument was outfitted with compressive clamps for compression tests of rectangular samples following the standard test method (ASTM D695). All samples were compressed to 50% strain at a speed of 5 mm/min. Statistical results were the average value of five samples.

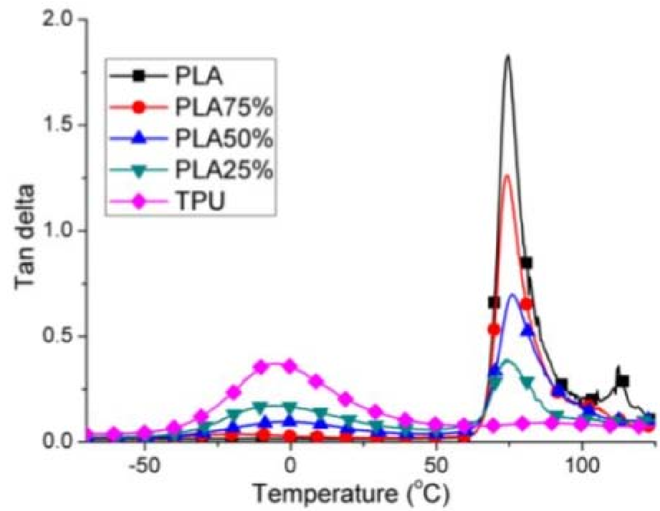


Figure 1: FTIR results of PLA, PLA75%, PLA50%, PLA25%, and TPU samples. ANTEC® 2013 / 1636

Viscosity

The complex viscosity of the pure material and the blends was measured via a rheometer (AR 2000ex). A 25 mm, 0 ETC steel plate geometry was used and all of the tests were performed at 190°C, with an increase in angular frequency from 0.1 to 200 rad/s.

Results and Discussion

Miscibility of TPU and PLA

FTIR Results

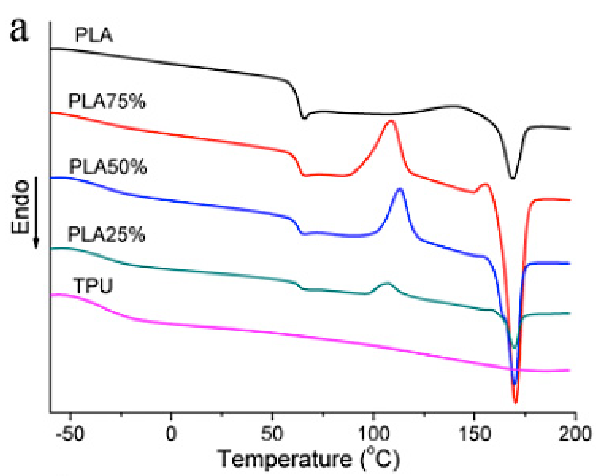
FTIR was used to identify the molecular construction of the blends. As shown in **Figure 1**, the peak at 3332 cm^{-1}, which indicates the N–H group in urethane (–NHCOO–), and the peaks at 2935 and 2850 cm^{-1}, which belong to the asymmetric and symmetric vibration of the $-CH_2$ group, are characteristic peaks of TPU. Furthermore, the intensity of the peaks in the blends was enhanced by increasing TPU content. The –C=O group peak at 1748 cm^{-1} only existed in PLA, and the peak intensity decreased with increasing TPU content. FTIR results confirmed that PLA and TPU were compound successfully and no chemical reaction happened during melt blending since no new chemical bonds were identified.

DSC and DMA Analysis

DSC results shown in **Figure 2** indicate that TPU and PLA were immiscible, which can be diagnosed from the completely separate glass transition slopes. As the TPU content increased, the glass transition temperature (Tg) of the two components remained constant, while the slope of the TPU became steeper and the

IMD Best Paper Continued

Figure 2: DSC results of pure materials and blends: (a) second heating and (b) cooling.



slope belonging to the PLA became shallower. It was also found from **Figure 2 (a)** that the PLA cold crystallization peak moved to a lower temperature and the peak intensity became sharper in the PLA75% and PLA50% samples. This phenomenon can be attributed to the addition of TPU, which acted as a crystallization nucleation agent by providing nucleation sites for the PLA. Among the three blends, both the cold crystallization peak and the melting peak became smaller with increasing TPU content. **Figure 2 (b)** shows the cooling period, where it can be seen that PLA stimulates TPU crystallization as well, with the peak becoming stronger as PLA content increases.

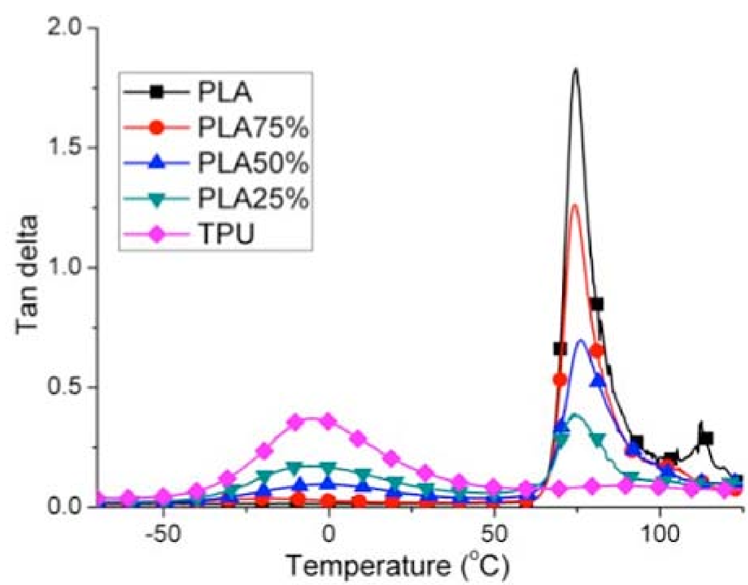


Figure 3: DMA tan delta results of pure materials and blends.

The tan delta results from the DMA test (**cf. Figure 3**) clearly showed the immiscibility of TPU and PLA as well. The depletion peak for the TPU content was below zero and became weaker as the PLA content increased. Similarly, the PLA depletion peak, which occurred around 76 , became smaller when the TPU content increased. All of the blends had two peaks at the same temperatures as pure TPU and PLA, which confirmed that the PLA and TPU used in this study were completely immiscible. The sharp peak for PLA indicated rapid storage energy loss.

IMD Best Paper Continued

Phase Morphology

SEM was used to further study the phase morphology of PLA/TPU blends. The pure PLA and TPU fractured surface morphology results are shown in **Figure 4 (a)** and **(b)**, respectively, for comparison. **Figures 4 (c)** through **(e)** show the phase morphology of the three blends. A large portion of the PLA spheres were uniformly inlaid in the TPU matrix. No continuous PLA phase was observed in the PLA75% sample even though the spheres were large and almost connected to each other. The PLA50% sample had both PLA and TPU continuous phases, as well as some PLA spheres, as shown in **Figure 4 (d)**. The PLA domain, however, formed islands inside of the TPU matrix (circled in the image), and the spheres were much fewer than in the PLA75% sample. As shown in **Figure 4 (e)**, the PLA25% sample had tinny PLA spheres that were much smaller and less frequent than in the PLA75% sample and were also uniformly dispersed in the TPU matrix. In brief, clear phase separation was observed in all three blends, which further proves that PLA was completely immiscible with TPU.

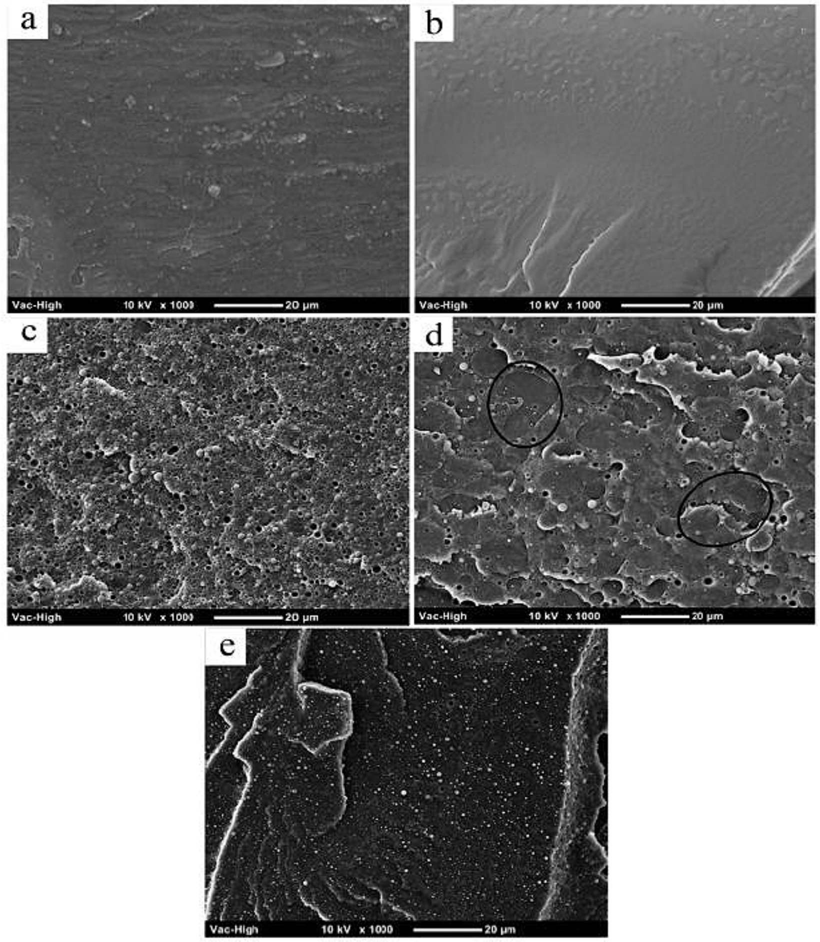


Figure 4: SEM phase morphology of (a) PLA, (b) TPU, (c) PLA75%, (d) PLA50%, and (e) PLA25% solid samples.

Scaffold Morphology

The microstructures of the foamed samples are shown in **Figure 5**. The morphology of the pure PLA and TPU were significantly different and the cell structure varied between blends. It was found that the cell size of the TPU was much larger than that of PLA, and more cells had small holes which could connect with other cells. The PLA75% sample (**Figure 5 (c1)**) had a similar structure to the pure PLA sample. Furthermore, the morphology of the PLA25% sample (**Figure 5 (e1)**) was close to that of pure TPU. The PLA50% sample (**Figure 5 (d1)**) had large hollow regions and small cells. It is likely that the difference in scaffold microstructure could be attributed to the various phase morphologies.

The PLA and TPU phase interfaces provide hetero-geneous nucleation points during foaming. The enlarged images show the phase morphology of the cell surface and cell wall. Pure materials (**Figures (a2)** and **(b2)**) have relatively smooth cell surfaces, while the surfaces of the other three blends were rough. Large PLA spheres were found inlaid in the PLA75% scaffold, forming a rough cell wall and small hollow regions on the cell surfaces. The two-phase morphology in the PLA50% scaffold in both cell wall and cell

IMD Best Paper Continued

surface can be clearly seen in **Figure 5 (d2)**. The PLA25% scaffold (**Figure 5 (e2)**) had tiny PLA spheres dispersed uniformly on the cell surface, thus forming a rough surface.

Mechanical and Rheological Properties

Tensile and Compressive Tests

The tensile and compressive test results of solid and foamed samples are shown in **Figure 6**, and the tensile modulus and compressive modulus statistical results are shown in **Figure 7.** Pure PLA had a high tensile modulus as well as compressive modulus, but an extremely low elongation-at-break due to its brittle nature. The tensile and compressive yield stresses decreased with the addition of TPU. In addition, the stresses decreased with decreasing PLA content. Solid TPU samples and blend samples did not break during the tensile test, even when the strain reached 600% as shown in **Figure 6 (a)**. **Figure 6 (b)** shows that the strain-at-break increased with increasing TPU content for foamed samples, and that the samples lost yield behavior when the PLA content decreased to 25%. The compression test showed similar results as the tensile test. In **Figures 6 (c)** and **(d)**, it can be seen that the compressive modulus decreased with increasing TPU content. Furthermore, the compressive stress for foamed samples was significantly lower than that of solid samples. According to the histogram data

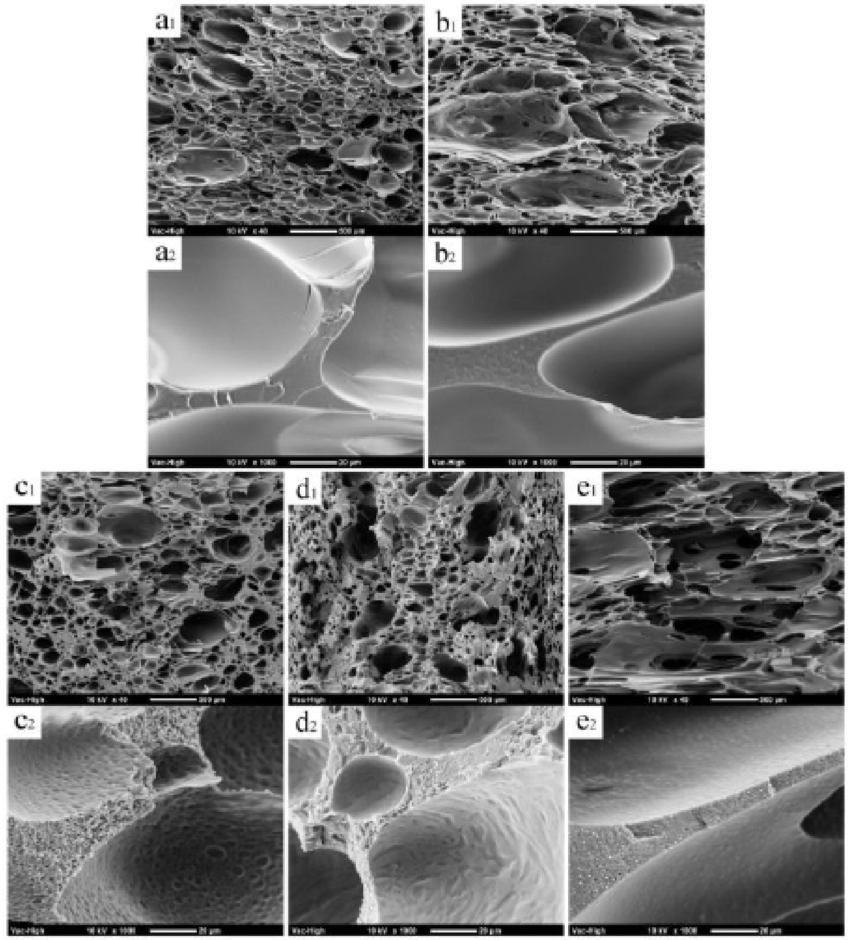


Figure 5: SEM images of microcellular injection molded samples: (a) PLA, (b) TPU, (c) PLA75%, (d) PLA50%, and (e) PLA 25%. Subscript 2 images are enlarged images of subscript 1 images.

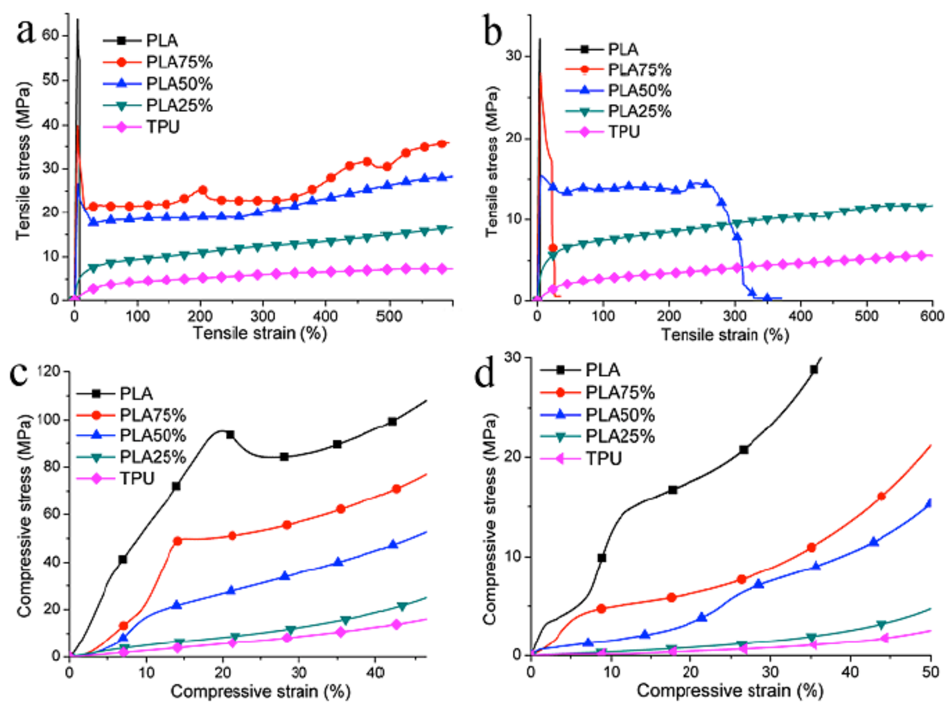


Figure 6: Mechanical property tests: (a) tensile test of solid samples, (b) tensile test of foamed samples, (c) compressive test of solid samples, and (d) compressive test of foamed samples.

IMD Best Paper Continued

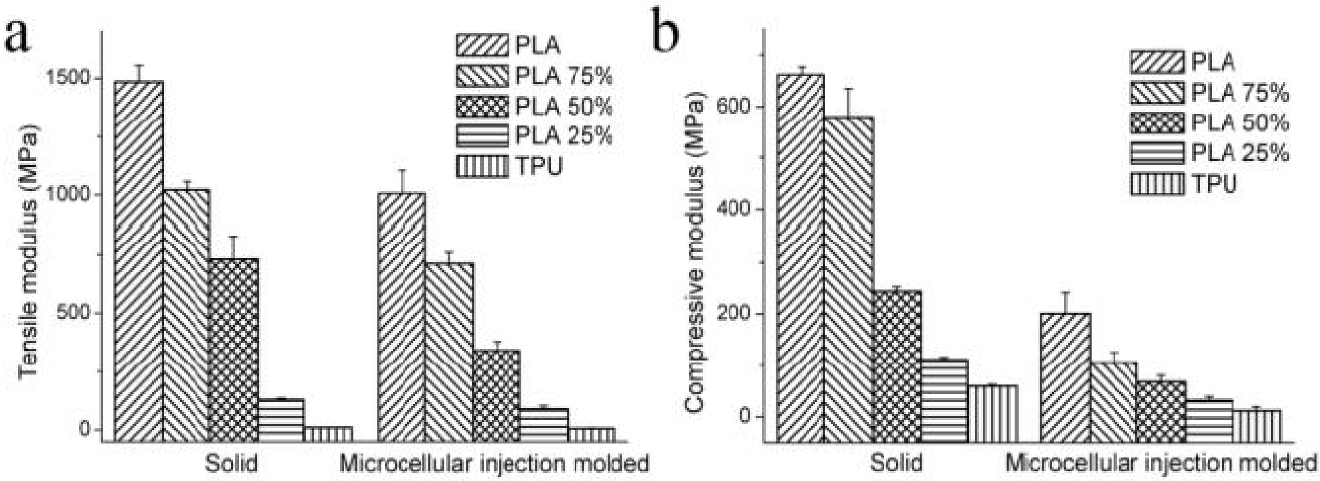


Figure 7: Statistical histogram of (a) tensile modulus and (b) compressive modulus for both solid and foamed samples.

in **Figure 7**, both the tensile modulus and the compressive modulus decreased as the TPU content increased. The tensile modulus of foamed samples was lower than that of solid samples and ranged from 7 to 1007 MPa, which is large enough to cover several tissue applications. The compressive modulus for foams, which ranged from 11 to 200 MPa, would also fulfill some human tissue requirements.

Dynamic Mechanical Test

PLA had a higher storage modulus than TPU according to thermal dynamic tests, as shown in **Figure 8**. The storage modulus curves of the blends were located between PLA and TPU for both solid and foamed samples as expected. Interestingly, both solid and foamed PLA25% samples had a relatively high storage modulus at low temperatures. This might have been due to the reinforcement behavior of the rigid PLA spheres uniformly dispersed in the TPU matrix corresponding to the phase morphology images. As the temperature increased, the storage modulus dropped rapidly such that no improvements were observed in the tensile or compression tests at room temperature.

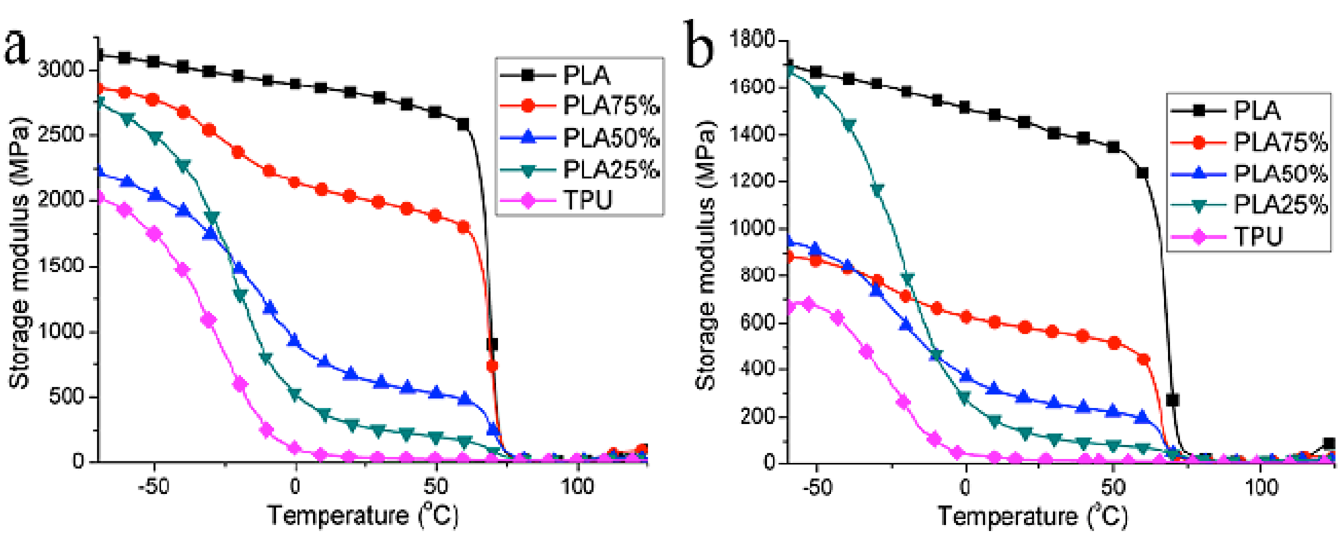


Figure 8: DMA storage modulus of pure materials and blends: (a) solid samples and (b) foamed samples.

Rheology Test

As shown in **Figure 9**, the complex viscosity increased along with the amount of TPU because pure TPU had a higher viscosity than pure PLA. The reinforcement behavior of PLA25% was also observed in the rheology tests at low angular frequencies. Together with the storage modulus results, it is possible that the tiny PLA spheres in the PLA25% were acting as rigid fillers, which significantly reinforced the blends at low temperatures or deformation frequencies. The PLA50% samples had a continuous PLA phase, while the PLA75% samples had large PLA spheres and a small TPU domain, thus no reinforcement behavior was observed in them.

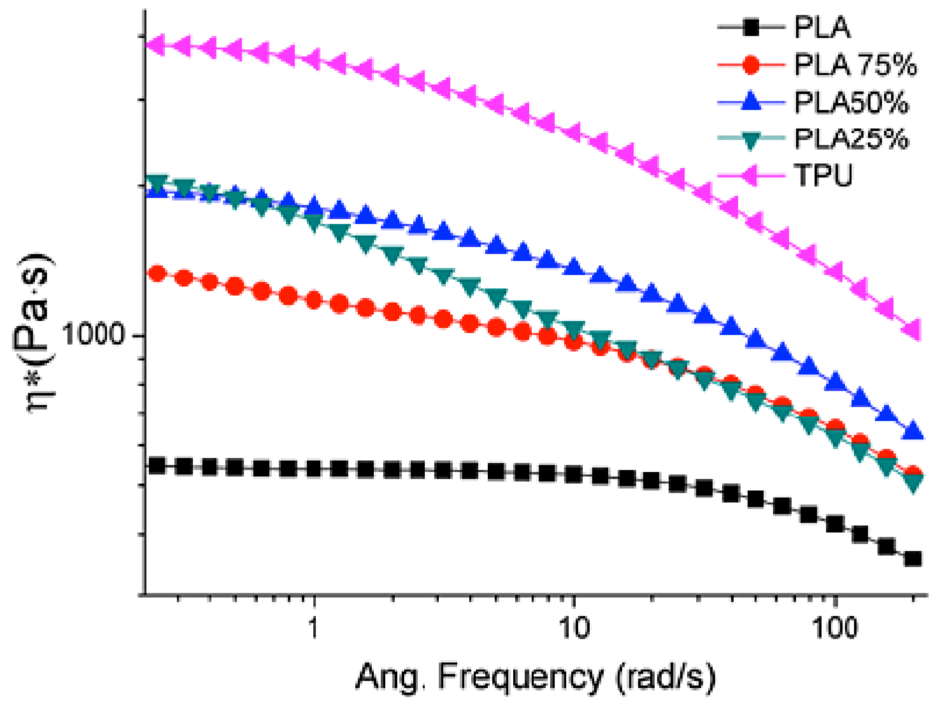


Figure 9: Complex viscosity of pure materials and blends.

Conclusions

TPU and PLA were melt blended in different ratios with a twin-screw extruder and microcellular injection molded to produce tissue scaffolds. The properties of pure materials and blends were investigated via multiple test methods. It was found that the PLA and TPU used in this study were completely immiscible and that the PLA dispersed as small spheres at a content of 25% or large spheres at a content of 75% in the TPU matrix. At a content of 50%, it formed into both spheres and islands, which increased the surface roughness of cells. Mechanical tests confirmed the large tensile and compressive ranges of the scaffolds fabricated by microcellular injection molding, which may be potentially used in multiple tissue applications. The elongation-at-break improved dramatically as the TPU content increased in the blends. The tiny dispersed PLA spheres in the TPU matrix at 25%PLA significantly reinforced the blends at low temperatures or deformation frequencies.

Acknowledgements

The authors would like to acknowledge the support of the Chinese Scholarship Council and the Wisconsin Institute for Discovery, the financial support of the National Nature Science Foundation of China (No.51073061, No.21174044), the Fundamental Research Funds for the Central Universities (No.2011ZZ0011) and 973 Program (2012CB025902).

References

[1] R. Langer, J.P. Vacanti, Science, 260, 920-926 (1993).

[2] Y.Z. Zhang, J. Venugopal, Z.M. Huang, C.T. Lim, S. Ramakrishna, Biomacromolecules, 6, 2583-2589 (2005).

[3] X.W. Wang, P. Lin, Q.H. Yao, C.Y. Chen, World J Surg, 31, 682-689 (2007).

[4] S.H. Oh, S.G. Kang, E.S. Kim, S.H. Cho, J.H. Lee, Biomaterials, 24, 4011-4021 (2003).

[5] S.F. Yang, K.F. Leong, Z.H. Du, C.K. Chua, Tissue Eng, 7, 679-689 (2001).

[6] J.S. Son, G. Teja, M. Appleford, J.L. Ong, K. Park, D.K. Han, S. Oh, Tissue Eng Regen Med, 6, 1241-1251 (2009).

[7] S.D. Wang, Y.Z. Zhang, G.B. Yin, H.W. Wang, Z.H. Dong, J Appl Polym Sci, 113, 2675-2682 (2009).

[8] C.H. Lohmann, Z. Schwartz, G.G. Niederauer, D.L. Carnes, D.D. Dean, B.B. Boyan, Biomaterials, 21, 49-61 (2000).

[9] S.A. Guelcher, Tissue Eng Pt B-Rev, 14, 3-17 (2008).

[10] A. Burke, N. Hasirci, Adv Exp Med Biol, 553, 83-101 (2004).

[11] A.G. Mikos, A.J. Thorsen, L.A. Czerwonka, Y. Bao, R. Langer, D.N. Winslow, J.P. Vacanti, Polymer, 35, 1068-1077 (1994).

[12] L. Wang, J. Shi, L. Liu, E. Secret, Y. Chen, Microelectron Eng, 88, 1718-1721 (2011).

[13] S.A. Park, H.J. Kim, S.H. Lee, J.H. Lee, H.K. Kim, T.R. Yoon, W. Kim, Polym Eng Sci, 51, 1883-1890 (2011).

[14] Y.M. Corre, A. Maazouz, J. Duchet, J. Reignier, J Supercrit Fluid, 58, 177-188 (2011).

[15] A. Kramschuster, L.S. Turng, J Biomed Mater Res B, 92B, 366-376 (2010). ANTEC® 2013 / 1639

IMD Board of Directors Meeting

September 20, 2013

Teleconference

Submitted by Hoa Pham, Secretary

Welcome

Chair Erik Foltz called the meeting to order at 1:05 PM ET. He welcomed all attendees to the teleconference meeting.

Roll Call

Present were: Erik Foltz (Chair), Susan Montgomery; Jim Wenskus; Peter Grelle; Hoa Pham; Pat Gorton; Adam Kramschuster; Jeremy Dworshak; Tom Turng; Srikanth Pilla; Brad Johnson, Jack Dispenza, Nick Fountas; Larry Schmidt; Lee Filbert; Kishor Mehta; David Kusuma; Raymond McKee and Michael Uhrain
Guests were: Barbara Spain (SPE Staff) and James Devita (Ticona)

Absent were: David Okonski and Rick Puglielli.
This constituted quorum.

Approval of April 21, 2013 Meeting Minutes

Motion: Hoa moved that the April 21, 2013 meeting minutes be approved, as written and distributed. Pete Grelle seconded and the motion carried.

Financial Report — Jim Wenskus, Treasurer

Jim presented the financials from July 1 to August 31. The rebate from SPE was received, and bills have been paid. Overall, the financial state was in good standing to allow the Board to continue funding the IMD Scholarship.

Pinnacle Award — Pat Gorton

Pat received the previous year forms from Erik and Susan. The new application form is available on the SPE website, and the due date is end of December 2013. Pat will contact Board members for items to meet the award requirements.

Technical Director Report — Peter Grelle, Chair

Schedule: Pete showed the schedule for upcoming activities, which included Paper Review to be held in mid-November 2013, the China TOPCON in December 2013, ANTEC 2014 and the TOPCON at Penn State-Erie in June 2014. The ANTEC paper reviewers are Adam, Pat, Raymond and Pete.

Injection Molding Webinar — Pete Grelle

Pete reported that he re-analyzed the survey results and comments. Based on the comments, he developed three tracks for the webinar. He planned to work with Barbara Spain on logistics, and with Raymond and Jeremy to elaborate on the topics.

Penn State TOPCON — Brad Johnson

Brad noted that the Penn State — Erie conference was scheduled from June 18 – 19, 2014. The theme is special to celebrate the 25th anniversary of the Plastics Program.

IMD Board of Directors Meeting Continued

China TOPCON — David Kusuma, Tom Turng

The team had a teleconference with the SPE HQ. Many good titles and abstracts were received from industry and universities. The team was also working to finalize the keynote speakers. Adding another dimension to the conference would be a joint session with Medical Plastics focusing on biopolymers. This TOPCON will be held December 11 – 12 in Shanghai, China.

Trainer Evaluation Scheduling — Jeremy Dworshak

Jeremy had been working with a marketing company to develop a pamphlet inviting trainers to participate. The design was shared with the Board to solicit feedback.

YouTube Channel — Erik Foltz, Rick Puglielli

Erik reported that a YouTube channel had been created for the IMD. The objective was to provide technical information to the injection molding industry. The plan was to reach a broader audience and provide a preview of the benefits of joining the SPE. Since access could not be restricted, the Board agreed with the suggestion to add this link to the SPE website, Facebook or LinkedIn. Discussions were made on addressing the incentives to engage companies that already had videos, and potential contributors creating new videos. The target was to obtain some content by the end of 2013.

Action Item: Erik to include in his Chair's message a call for content.

Councilor Report — Brad Johnson

No new report. The next Councilor meeting would be on November 16.

ANTEC 2014 Technical Program Committee — Adam Kramschuster

The review committee included Pat, Pete, Adam and Ray, and they would meet in mid-November at UW-Stout. The due date for papers is October 25, and the reviews are due to authors by November 22.

Adam reported that the committee was seeking more advanced topics, and keynote speakers.

IMD Reception

Susan noted that Moldex3D was willing to sponsor again. Discussions were made on having a banner for sponsors of the newsletter. Adam agreed to consider this suggestion. Erik and Susan volunteered to help get sponsorships for the reception.

Communications Committee — Adam Kramschuster

Adam reported that the newsletter received the first sponsored article. For current sponsors, receipts were up-to-date. Renewals were made until next Spring/Summer.

Although the IMD website was not live yet, Adam showed the Board the layout which followed the SPE style guide.

The schedule for the upcoming newsletter materials is:

- Fall (November 2013) – October 10
- Spring (March 2014) – Feb 10

IMD Board of Directors Meeting Continued

IMD Membership Committee — Nick Fountas

Nick noted that SPE seemed to have changed how the number of active members was determined. He showed a significant difference in the number obtained from the roster and the data pulled directly from the website. Barbara mentioned that the transition to the new Vectra system might have some effect in removing duplicates. Tom Conklin could provide better insights.

From the membership demographics, 75% of members came from within the US. Thus, Nick raised the question of focusing resources.

Action Item: Barbara to coordinate with Tom Conklin to provide clearer explanation on number of active members.

HSM & Fellows — Erik Foltz

Erik reported that there was a vacancy for the role of HSM & Fellows Chair. Larry who was the exiting Chair provided an overview of the role and responsibilities. Erik suggested that the Board considered a former Board member (already HSM & Fellows) to take on this role. The Board concurred and Erik agreed to contact a potential candidate.

Action Item: Erik to contact a former Board member to chair the HSM & Fellows

New Business — Erik Foltz, All

Initiative of Energy Incentive in California: Erik reported that he received and sent to the Board an inquiry from a molding consultant in California requesting the Division to comment on the decision of the California Public Utilities Commission to eliminate energy savings incentives to the injection molding industry in the state. The Board asserted that the SPE was a non-political entity. For political response or support, the SPI would be a more suitable organization to address this inquiry.

Action Item: Erik and Michael Uhrain to work on the response letter for this inquiry.

Michael Uhrain: Michael announced that he now has returned to the US from Germany and would be participating more in the Board meetings. He noted that he would like to invite guests to the next meeting. The Board welcomed Michael back, and asked him to provide bios of the guests prior to the winter meeting.

Old Business

Pete brought up the question of reorganizing the meeting at ANTEC, which was discussed at the last meeting. The possible option was to meet Tuesday afternoon and follow with an open session for members to participate prior to attending the IMD reception. Erik agreed to consider this option.

Next Meeting

The next Board meeting will be on January 31, 2014

Adjournment

Motion: Jack moved to adjourn the meeting. Pete seconded, and the meeting was adjourned.

IMD Leadership

DIVISION OFFICERS

IMD Chair
Erik Foltz
The Madison Group
erik@madisongroup.com

Chair-Elect
Pat Gorton
Energizer
pgorton@energizer.com

Treasurer
Jim Wenskus
wenskus1@frontier.com

Secretary
Assistant Treasurer
Nominations Comm.
Chair Historian
Hoa Pham
Avery Dennison
hp0802@live.com

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

Past Chair
Susan E. Montgomery
Priamus System Technologies
s.montgomery@priamus.com

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

BOARD OF DIRECTORS

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

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

TPC ANTEC 2016
Education Committee Chair
Jeremy Dworshak
Steinwall Inc.
jdworshak@steinwall.com

TPC ANTEC 2017
Rick Puglielli
Promold Plastics
rickp@promoldplastics.com

TPC ANTEC 2018
Srikanth Pilla
Clemson University
spilla@clemson.com

TPC ANTEC 2019
2013 China TOPCON Chair
David Kusuma
Tupperware
davidkusuma@tupperware.com

TPC ANTEC 2020
David Okonski
General Motors R&D Center
david.a.okonski@gm.com

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

Engineer-Of-The-Year Award
HSM & Fellows
Kishor Mehta
Plascon Associates, Inc
ksmehta100@gmail.com

Reception Committee Chair
Jack Dispenza
jackdispenza@gmail.com

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

Lee Filbert
IQMS
lfilbert@iqms.com

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

EMERITUS

Mal Murthy
Doss Plastics
Dosscor@GMAIL.com

Larry Schmidt
LR Schmidt Associates
schmidtlra@aol.com

IMD New Members

The Injection Molding Division Welcomes 170 New Members…

Mark Wallace Alexander
Peter Allan
Andrew James Angros
Dave Anthony
Yasir H. Arain
Sohail Asghar
David Ross Astbury
Dave S. Axford
Jane Barefield
Mark C. Baysinger
Clemens Behmenburg
Roy Biederman
Edmund T. Bird
John Birle
Andrew Blemings
Robert H. Boutier
Alvin Bromberek
Troy D. Campbell
Caleb Alexander Carter
Jacob Cartwright
Chris Cerasani
Sarath Chandran
Dyan N. Chong
Kyle J. Clare
John Clyne
Mark Colella
Steven Colquitt
Ron Conley
Bob Cook
Phillip A Cox
Justin E. Crawford
Sean T. Crowley
Stephen Cunningham
Lisa L. D'Amico
Shannon Claire Davey
John Edward Davis
Leo Devellian
Mark W. Dixon
Michael G. Eck
Chelsea Marie Ehlert
Joerg Ehmann
John A. Elder
Mark Enlow
Michael Evans
George Faber
Steven Fage
Andre Faria
Pat Fenell
Rosa Fernandez
Pascal Andre Ferrandez
Michael E. Foote
Gwendolyn Frederick
Jason Frendo
Renato Michelin Galesi
Joseph S. Gano
Anthony Genova
Kevin T. Glass
Jason Gotch
Michael Griffitts
Justin R. Grumski
Steve Hagerman
Larry Harris
Bruce Harrison
Benjamin Philip Heine
Daniel Hille
Mike Hoeppner
Martin Höer
Eric A. Honeycutt
Donovan Rhett Hubbart
Richard Huchko
Mohammed Islam
Xin Jing
Gerald Johnson
Curt Johnstun
Ronald J. Juedes
Raju Kalidindi
Joel T. Kaminski
James Kegelman
Dharmendra Khanolkar
Clinton Kietzmann
Leslie Klar
John Klever
Greg Koob
Bryan Kraft
Alexander Kudakkachira
Qi Li
Peter Lucas
Kelsey Lynn Luibrand
Leroy D. Luther
Anthony Lytsikas
Yasuhiko Machitani
Ray Mallet
Richard Markham
Walter Masnyk
Jimmy Masrin
Susan Michaeli
Raj Mody
Guillermo Molteni
Steven G. Morgan
Ronald L. Mudd
Kevin S. Newland
Daniel Noriegn
John Nowell
Sami Obeid
Eddie Oropeza
Greg Osborn
Gernot Alois Pacher
Muthu Pannirselvam
John Parrington
Anup Patel
Sriraj Patel
Eric B. Pennell
Mario A. Perez
Randy Peslar

IMD New Members Continued

John Peterson
Tyler John Phelps
Gregory Andrew Plotts
Gregory Pracy
Ryan M. Prunty
Kelly Puckett
Gerardo Puig
William Purcell
Jeff Putnam
Peter Quinn
Rick Quinn
Sean Rainsford
Eben Solomon Rajan
Alvaro Jose Ramirez
Joe Reimer
Jess T. Rhodes
Christopher E. Richards
Don Rodda
Mark Roodvoets
John A. Ross
William R. Rousseau
Al H. Rouwenhorst
Mehdi Saniei
Michael John Scott
Stephen Scott
Brett Smith
Nitin Sood
Alex J. Sorenson
Henry J. Sorgen
Jim Stewart
Desmond B. Street
Fritz Strehlow
Willard Sullivan
Dennis Swartz
George Thirlaway
Evan G. Thomas
Wayne Bredefeld Thomas
Jamie Thomson
Muluken Tilahun
Eduardo Tineo
Mitch Turnipseed
Varthanan Vishnu
Mikael Steven Wagner
Paul Walach
Michael K. Waldrep
Thomas Walker
Brian Walsh
Sharon Willaims
John Williams
Robert A. Wilson
David S. Wolf
Stephen R. Wolfer
Andrew Wooley
Michael C. Wright-Dowd
Hongyue Yuan

...from 14 countries:

Argentina
Australia
Austria
Brazil
Canada
Colombia
Denmark
Germany
Greece
India
Japan
Oman
United Kingdom
U.S.A.

...representing more than 125 organizations including:

5 Nines Automation LLC
A&A Global Industries
A. Finkl & Sons Co.
Acushnet Co.
Advanced Fluid Systems, Inc.
ALBA Enterprises
Amsted Rail
Anderson Power Products
Aspen Research Corp.
Auriga Polymers
Autodesk Australia Pty. Ltd.
BPC Manufacturing
Barbury Co.
Bemis
Bennett Precision Tooling Pty. Ltd.
BIC Violex S.A.
Bluestar Silicones
BMS Vision
Boucherie USA Inc.
Carvajal Empaques
Central Carolina Community College
Chase Plastic Services Inc.
Chemplast Inc.
CIMA Plastics Group
Clariant Australia Pty. Ltd.
CommScope
Comtec IPE
Cooper Standard
CRE Enterprises Inc.
Currier Plastics Inc.
Custom Engineered Wheels
Dana
Deb Dispensing Inc.
Demag Plastics Group
Dept. of Printing Technology
Dollplast Machinery Inc.
Draexlmaier Automotive of America LLC
E. I. DuPont India Pvt. Ltd.

IMD New Members Continued

EMD Millipore Corp.
Evonik
Fast Heat Inc.
Fenner Advanced Sealing Technologies
Ferris State U.
Formosa Plastics Corp.
GE India Tech. Center Pvt. Ltd.
GLE Enterprises LLC
Global Mould and Design Pty. Ltd.
Goettfert
Guateplast
Hewlett Packard
Hoosier Pride Plastics Inc.
Houston Plastic Products
Industrial Scientific
Ingredion Inc.
Institut for Plastics Processing (IKV) Aachen
ITW Filtertek
JR-Cape Management Consulting Group
KPMG LLP
Kraft Foods
Laird Technologies
Lehigh University
LioChem Inc.
Marplex Australia Pty. Ltd.
Meadoworks
Meridian Medical Technologies
Metro Mold and Design
Mid-Florida Plastics
Milacron LLC
Munro & Associates
Nike Inc.
Oman Cables Industry
Orbis Corp.
Parker Hannifin
Penn State U. - Behrend
Pentair
Pikes Peak Plastics Inc
PIM Machinery
Plastic Injection Molding Inc.
Polymer Competence Center Leoben GmbH
PolymerOhio Inc.
Polymers International Australia Pty. Ltd.
Ravago
RJS Quinn
RMIT University
Robert Bosch GmbH
Rochester Midland Corp.
Rosti Technical Plastics
SABIC Innovative Plastics
Sanluis Rassini
Scan Tool & Mold Inc.
Schoeller Allibert Inc.
Schuler Inc.
Senninger Irrigation
Siemens
Silgan ipec
Smiths Medical
Stant
Stemmerich Inc.
Sumitomo Bakelite North America Inc.
Supplier Technology & Engineering
Support SVC LLC
SUSSEXIM
Synventive Molding Solutions
TE Connectivity
Technical Polymers
Technical University of Denmark
The Mentor Group
Toyo Seikan Kaisya Ltd.
Triangle Tool Corp.
TS Tech North America Inc.
United Plastics Group
U. Massachusetts - Lowell
U. Toronto
U. Wisconsin - Stout
U. Wisconsin - Madison
Washington Penn Plastics
Weiler Engineering
WES Plastics Pty. Ltd.
Winona State U.
Wisconsin Engraving
WittmanBattenfeld Aust. Pty. Ltd.
Wolfson Centre for Materials Processing
Xaloy Inc.

Membership Application

SOCIETY OF PLASTICS ENGINEERS MEMBERSHIP APPLICATION

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

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

Applicant Information: (please print)

My Primary Address is home_____ or business_____ (check one)

Name ________________ ______ __________________________
First MI Last

Organization Name_______________________________________

Address ____

Address ____

Address ____

City_______________________State__________________________

Zip/Postal Code_____________ Country______________

Phone Number________________________ Home___ Work____ Cell___

Job Title____

Email(Required Field)____

Alternate Email ____

Date of Birth___________________ Graduation Date*_________________

Gender: Male _____Female_____ *Required for Student Membership

Membership Types (please check one)

_____ Student $31 **_____Young Professional $99** **_____Professional $144(**includes $15 new member initiation fee)
Choose up to 2 Member Groups on the back of this application.

_____Professional +2 Additional Member Groups $**164** Choose up to 4 Additional Member Groups on the back of this application.

_____Professional +4 Additional Member Groups $184 Choose up to 6 Additional Member Groups on the back of this application.

Payment Information: **PAYMENT MUST ACCOMPANY APPLICATION-NO PURCHASE ORDERS ACCEPTED**

Amount____________ Check Number_________________ Cash _______________

Credit Card Information (Check One) American Express_______ Visa_______ MasterCard________

Credit Card Number____ Exp. Date__________ Security Code________

Name On Credit Card____ Amount____________

By signing below I agree to be governed by the Bylaws of the Society and to promote the objectives of the Society. I certify that the statements made in the application are correct and I authorize SPE and its affiliates to use my phone, fax, address and email to contact me.

Signature____ Date_______________

Recommended by_____________________________ ID#______________________

The SPE Online Membership Directory is included with membership. Your information will be automatically included.
______ Exclude my email from the Online Membership Directory.
______ Exclude all my information from the Online Membership Directory.
______ Exclude my address from 3rd party mailings.

Dues include a 1year subscription to *Plastics Engineering* magazine-$38.00 value (non-deductible). SPE membership is valid for twelve months from the date your membership is processed.

Member Groups

Technical Area of Interests(Divisions)

A Technical Area of Interest gives you access to up-to-the-minute, specialized, technical information and an international community of colleagues in your area of interest. It enhances your membership by providing more targeted, practical advice, from proven experts and professionals currently working in your field.

Please circle choice(s) below:

None

Additives & Colors Europe - D45
Automotive - D31
Blow Molding - D30
Color & Appearance - D21
Composites - D39
Decorating & Assembly - D34
Electrical & Electronic - D24
Engineering Properties & Structure - D26
European Medical Polymers - D46
Extrusion - D22
Flexible Packaging - D44
Injection Molding - D23
Medical Plastics Technical Area of Interest - D36
Mold Making & Mold Design - D35
Plastics Environmental - D40
Polymer Analysis - D33
Polymer Modifiers & Additives - D38
Product Design & Development - D41
Rotational Molding - D42
Thermoforming - D25
European Thermoforming - D43
Thermoplastic Materials & Foams - D29
Thermoset - D28
Vinyl Plastics - D27

Geographic Locations(Sections)

A Geographic Location connects you to your local plastics colleagues and your local industry. Please circle choice(s) below:

None
Alabama-Georgia-Southern
Arkansas
Australia - New Zealand
Benelux
Brazil
California - Golden Gate
California - Southern California
Caribbean
Carolinas
Central Europe
Colorado - Rocky Mountain
Connecticut
Eastern New England
Florida - Central Florida
Florida - South Florida
France
Hong Kong
Illinois-Chicago
India
Indiana-Central Indiana
Iowa
Israel
Italy
Japan
Kansas City
Korea
Louisiana-Gulf South Central
Maryland-Baltimore-Washington
Mass-New Hampshire-Pioneer Valley
Mexico-Centro
Michiana
Michigan-Detroit
Michigan-Mid Michigan
Michigan-Western Michigan
Middle East
Mississippi
Missouri
Nebraska
New Jersey - Palisades-New Jersey
New York
New York-Binghamton-Scranton
New York-Rochester
New York Mid-Hudson
North Carolina-Piedmont Coastal
Ohio-Akron
Ohio-Cleveland
Ohio-Miami Valley
Ohio-Toledo
Ohio-Firelands
Oklahoma
Ontario
Oregon-Columbia River
Pennsylvania-Lehigh Valley
Pennsylvania-Northwestern Pennsylvania
Pennsylvania-Philadelphia
Pennsylvania-Pittsburgh
Pennsylvania-Susquehanna
Portugal
Quebec
Southeastern New England
Spain
Taiwan
Tennessee-Smoky Mountain
Tennessee-Tennessee Valley
Texas-Central Texas
Texas-Lower Rio Grande Valley
Texas-North Texas
Texas-South Texas
Turkey
United Kingdom & Ireland
Upper Midwest
Utah-Great Salt Lake
Virginia
Washington-Pacific Northwest
West Virginia Southeastern Ohio
Western New England
Wisconsin-Milwaukee

Special Interest Groups(SIGs)

Special Interest Groups are where like-minded Plastics professionals come together to explore the emerging science, technologies and practices that will shape the plastics industry. There is no charge for membership. Choose as many as you would like. Please circle choice(s) below:

Advanced Energy Storage – SIG 024
Alloys and Blends – SIG 010
Applied Rheology – SIG 013
Bioplastics – SIG 028
Composites Europe – SIG 026
Extrusion Europe – SIG 025
Failure Analysis and Prevention – SIG 002
Joining of Plastics and Composites – SIG 012
Marketing & Management Division – SIG 029
Nano/Micro Molding – SIG 023
Non-Halogen Flame Retardant Tech-SIG 030
Plastic Pipe and Fittings – SIG 021
Plastics Educators – SIG 018
Plastics in Building and Construction – SIG 027
Process Monitoring and Control – SIG 016
Quality and Continuous Improvement – SIG 005
Radiation Processing of Polymers – SIG 019
Rapid Design, Engineering and Mold Making – SIG 020
Thermoplastic Elastomers - SIG 006

Publisher Note | Sponsors

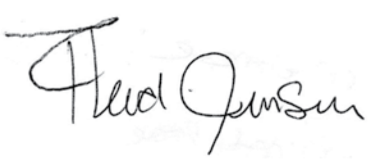
Message from the Publisher

I hope you enjoyed this issue of *Molding Views*. *Molding Views*. A big thank you for this issues supporters with their article contributions and sponsorships.

The SPE Injection Molding Division is reaching out to all members for support for the 2014 year. We are currently seeking trainers in injection molding. Plus article contributions, case studies, maintenance tips or any other informative write up to help your fellow members are always accepted throughout the year. If you or anyone you know could be a contributor please contact us!

Don't forget to visit us on LinkedIn! Daily discussions are held by SPE and members. Plus a new web site for SPE Injection Molders is coming soon. If you have any ideas or suggestions on topics you want more information on please e-mail PublisherIMDNewsletter@gmail.com

Thank you all, stay in touch and see you in 2014!



Heidi Jensen
PublisherIMDNewsletter@gmail.com

A big thank you to the authors and sponsors who supported this month's issue.

AMSA Inc. **22**
www.amsainc.com

Incoe **19**
www.incoe.com

Molding Business Services **2**
www.moldingbusiness.com

Noren Products Incorporated **15**
www.norenproducts.com

P.E.T.S **8**
www.petsinc.net

Priamus **3**
www.priamus.com

Progressive Components **23**
www.procomps.com

MARKETING OPPORTUNITIES AVAILABLE!

Support Your Injection Molding Division

Sponsorships opportunities in many forms to fit many budgets.

Sponsor ads: 1X, 2X or each issue
Sponsor articles: Various sizes and combinations (1X only)
Article submissions: Informative non-commercial articles available all year.

Your support puts your company in front of over 5000 professionals in the Injection Molding Industry.

The Injection Molding Division publication is issued three times a year to ***current and past members*** worldwide.

For more information on sponsorships and/or articles please e-mail:
PublisherIMDNewsletter@gmail.com