MOLDING VIEWS

INJECTION MOLDING

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Summer 2018 | No. 107

Chair's Message

Srikanth Pilla

Dear SPE Injection Molding Community:

I am honored to take over as the next chairman of the injection molding division (IMD). We just finished a very successful ANTEC where we have seen several high-impact technical presentations spanning broad range of topics including injection molding principles, advanced materials for injection molding, mold technologies, special injection molding processes, mold and process simulations and product design and development.

While it is an honor to serve the injection molding community, we also take utmost pride in instituting a new award aka, Outstanding Young Injection Molding Engineer award. The award is instituted to recognize young engineers, age 35 or younger, who have made exceptional contributions and accomplishments in the molding industry.

The IMD is at the core of its mission, especially in providing services and solutions to its community. We are not just providing a platform for academicians to present their latest discoveries but also the industry engineers to share their innovations, experiences and solutions. Also, we aim to motivate and inspire the next generation cohort of engineers. In support of this, IMD is undertaking several initiatives including funding student design projects, scholarships, web-based tutorials, a learning youtube channel, etc. All these activities are not possible without the generous support of our sponsors, the board members and the community. I extend my sincere thanks to all of them. As we step into the new team of board governance, we look forward to providing increased value to your IMD membership while also fulfilling our core mission and service.

Sincerely,

Srikanth Pilla
2018-2019 IMD Chair
Clemson University
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In This Issue:

Letter from the Chair 1
Industry Events 2
Webinar Listings 3

This Month's Features:

Accounting for Residual Stress in Injection Molded Parts 4
| *Erik Foltz and Richie Anfinsen., The Madison Group*

Film-insert Injection Compression Molding for Reinforced Polycarbonate with Woven Glass Fiber 9
| *Omar Solorza-Nicolasa,*, Hilario Hernandez-Morenob, Orlando Susarrey-Huertaa, Nestor Romero-Partidac*

Prognostic Medical Devices— The Wave of the Future 18
| *Rey Parel, SPE Golden Gate Sectiony*

IMD Board Minutes 23
IMD Leadership 29
IMD New Members 31
Publisher's Message 32

Industry Events Calendar

Click the show links for more information on these events!

SEPTEMBER 2018

SEPTEMBER 10 - 15
IMTS 2018
McCormick Place, Chicago, IL

SEPTEMBER 11 - 14
FOAMS 2018
Montreal Canada

SEPTEMBER 18 - 20
Thermoplastic Elastomers Conference
Akron, OH

SEPTEMBER 23
SPE Color and Appearance Conference
(CAD TETEC®)
Charleston, SC

OCTOBER 2018

OCTOBER 8 - 10
Annual Blow Molding Conference
Pittsburgh, PA

OCTOBER 23
SPE FlexPackCon® 2018
Phoenix, AZ

Congratulations!

2018 Injection Molding Division (IMD) Lifetime Achievement Award

Congratulations Jim Wenskus!

The Injection Molding Division wishes to congratulate one of their honored board members for being this years recipient of the 2018 Injection Molding Division Lifetime Achievement Award.

Jim has been a loyal contributor and asset to the SPE Injection Molding Divisions. He has served many years of dedication to our division and we wish to thank him for all his dedicated time and efforts to our group.

2018 Injection Molding Scholar, Recipient

Congratulations Mr. Kyle Plocharczyk!

Kyle Plocharczyk is entering HIS first year of graduate school at the University of Massachusetts Lowell. He has received a B.S. in Plastics Engineering from UMass Lowell and will be continuing the same pathway for his M.S. He is from Haverhill, MA where he resides with his mother Sonya.

Growing up Kyle has always known that he wanted to pursue a career involving math and science but it was only until visiting UMass Lowell and speaking to Prof. Malloy and Prof. Johnston that he felt like plastics engineering was the right fit for him.

Outside of school, he loves to travel and stay active by either working out or playing pickup sports with friends. Kyle is greatly honored to be receiving the SPE Injection Molding Division Scholarship which will help in finishing his college career.

Webinars

Design of Experiments for Injection Molding

Injection molding is a very complex procedure that combines part and mold designs, materials, and process conditions. Each factor has a great impact on the final part quality. Getting the right combination of all factors requires trial-and-error, which consumes a lot of time and money. Moldex3D Expert is a powerful tool that can help evaluate and optimize process design using statistical Design of Experiments. Determining the optimum conditions for any given part / mold design will help achieve better part quality before even going to the mold.

View Now>

6 Purging Tips to Maximize Processing Efficiency

Every successful processor looks for new ways to get an edge on their competiton. In this webinar you will learn 6 easy ways to maximize your efficiency and get a competitive advantage. Purging Expert Jarred Packard will explain how to start using a purging program, and how to effectively measure your results against your current process. You will learn several actionable tips that can provide major cost savings through reduced scrap and downtime.

View Now>

Avoid Plastic Injection Molding Problems

In this 30-minute webinar, learn how to predict plastic behavior and give an inside look at molding before steel is cut with SOLIDWORKS Plastics.

View Now>

By Erik Foltz and Richie Anfinsen,
The Madison Group

Accounting for Residual Stress in Injection Molded Parts

Injection molding has been the dominate process for producing complex, tight tolerance plastic parts. The plastic resin experiences aggressive conditions during the process, which is driven by the need to economically manufacture these components while maintaining the desired tolerances and surface aesthetics. From the shear deformation the polymer molecules experience as they are being melted and injected into the mold, to the rapid cooling of the resin as it comes into contact with the cold mold wall, the orientation and extension of the polymer chains change significantly from its original state. Additionally, the polymer chains cannot always get back into the state they want to be in, which leaves those areas of the part in a non-ideal state that develops stress from molding. This stress is often referred to as residual stress, or molded-in stress. The presence of these stresses is not always obvious, and has been largely ignored in the past due to the difficulty in quantifying them. However, these stresses can be significant and can lead to performance issues for molded parts such as dimensional stability, optical distortion, cracking, and part brittleness. This article will discuss how these stresses develop, and how they can be quantified.

How Does the Stress Develop?

During the injection molding process, the molten resin is injected into a mold to form the part. Prior to injection, the long polymer chains are entangled and in a relatively random orientation. However, during injection these same chains are subjected to shear forces that cause them to align and stretch in the direction of flow. While this alignment and elongation has some benefits, such as reducing the viscosity of the polymer melt, it also places the polymer chains in a stressed state. Once the polymer melt touches the cold mold wall, the polymer chain is frozen in this elongated state and a tensile stress is developed in the part, **Figure 1**. Additionally, the molten plastic continues to flow inside this frozen material and the polymer chains immediately adjacent to this layer are also placed in a state of tension. The thickness and magnitude of this tensile stress zone are often driven by how fast the mold is filled and the mold surface temperature. These tensile stresses can be further magnified at sharp corners in the part or at core pins, where the polymer chain initially freezes upon initial contact, but then is further stretched as the material continues to flow around the feature.

Stresses continue to develop in the molten resin during the packing stage. The pressure that is applied during this stage, to compensate for the volumetric shrinkage of the polymer melt as it solidified, restricts the polymers ability to get the chains in their preferred orientation and develop stress. This is a particular problem near the gate, where hot material is continually being introduced into the mold and the injection pressure is highest. These conditions create the most restriction to the polymer mobility, and do not allow the polymer chains to get into their desired state.

Accounting for Residual Stress in Injection Molded Parts

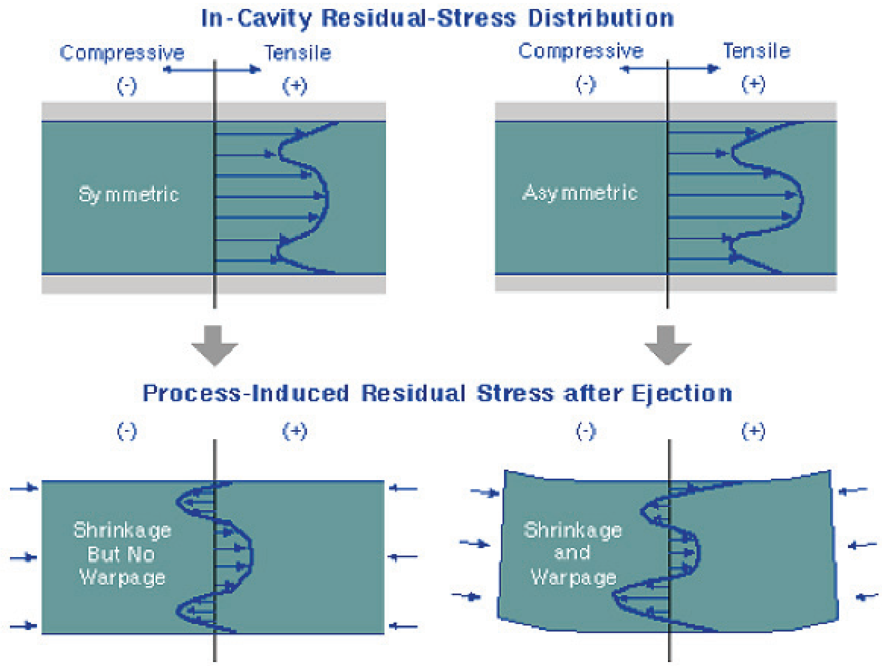

Figure 1: Schematic of Residual Stress Development in Injection Molded Part. Source: Autodesk Moldflow Design Guide

Stress can also be developed in areas remote from the gate, if they cannot be adequately packed out. If pressure cannot be maintained on the polymer melt until it has cooled sufficiently, the polymer will exhibit a greater amount of shrinkage than the surrounding area. This shrinkage gradient will cause stress to develop as the polymer chains are stretched to occupy this volume. Sometimes, there are visible cues such as warpage, sink mark formation or voids. However, other times there is no visual sign that the plastic part is under stress. Regardless, of the reason for stress, if the polymer molecules cannot get into their preferred orientation during the molding cycle, they will try to relieve this stress and get into their preferred state after being ejected. If enough movement of the chains occur, cracking and crazing can occur, which can weaken the part. Additionally, these stresses take time to dissipate and will superimpose on any operational stresses the part experiences while in service. Therefore, the impact and long-term creep performance, as well as the chemical resistance of the product can be adversely affected.

How to Quantify the Stress?

The combination of more demanding performance criteria, longer service life, and increasing part complexity have forced part designers to better understand the magnitude and distribution of residual stress in their molded parts. Therefore, they must have a method to quantify these stresses. With the ability to quantify the residual stresses, the designer or manufacturer can optimize the part or mold design, and process to yield a better product. There are numerous methods that can be used to help provide an estimate of how much stress exists in the part. A few of these methods are presented below. While the list is not exhaustive, it provides an initial basis for the reader to understand how they might quantify the residual stress in their part

Photoelastic Stress Analysis (PSA)

If the component is a relatively simple geometry, and is manufactured from an amorphous resin, photoelastic stress analysis could help provide a measure of the stress present in your molded part. This method relies on measuring the birefringence of polarized light, or how the velocity (speed and direction) of the light changes as it passes through the plastic specimen. This birefringence generates a color contour pattern on the part that relates to the amount of stress that exists through the cross-section of the part, **Figure 2**. Often times, this method is used to qualitatively evaluate the stress state in the molded part. The color generated and the spacing of the different color contours can help identify areas of high stress. While this method can provide directional input on how the residual stress changes for the part, it cannot easily be used to quantify the stress in the part. Additionally, the color contour provides a composite stress state through the cross-section of the part and does not distinguish between compressive or tensile stresses. This method can be used to provide more quantitative results. However, a sophisticated piece of equipment called a polarimeter is required, and material characterization is required to identify a material constant. This material constant is unique to each material and requires a non-trivial characterization procedure.

While this method can be attractive as a low cost option to qualitatively evaluate the stress state of a physical molded product, there are some limitations. As stated previously, the part geometry has to be a relatively simple, generally plate like structure, to best use this method. While cylindrical specimens can be

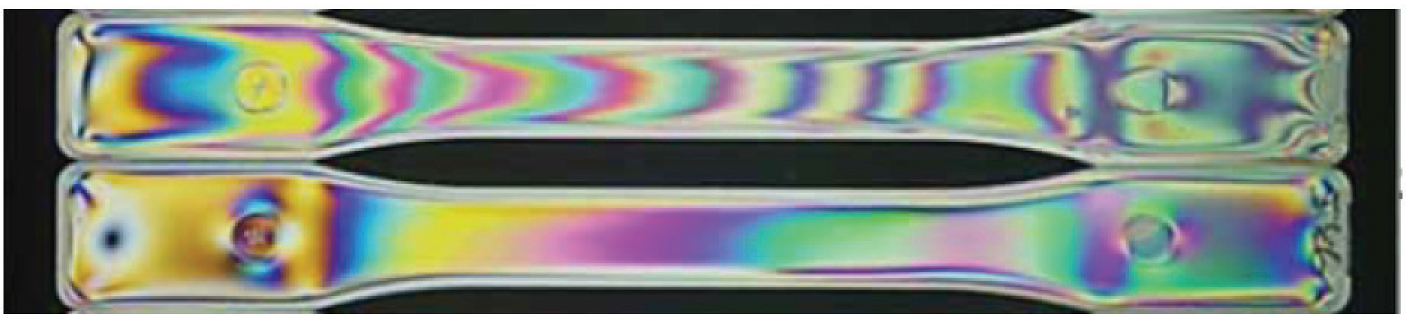

Figure 2: Image Highlighting the Birefringence Pattern in Polycarbonate Tensile Specimens using Photoelastic Stress Analysis.

accommodated and analyzed, the variable entrant angle of the polarized light and the viewing angle of the specimen reduce this method to a more qualitative evaluation. The specimen must also be manufactured from a transparent material that allows light to pass through it. Therefore, this is not an effective method for filled or semi-crystalline methods. However, this method even has limitations for amorphous resins, such as acrylic, that do not exhibit this birefringence pattern even when stress is present. This can limit the usefulness of this technique to only certain resins.

Solvent Stress Test

If the designer is more interested in the stress developed at the surface of the part, and the implications it may have on the chemical resistance of the part, an alternative may be to perform a solvent stress test. This test takes the molded specimens and submerges them into different concentrations of solvent mixtures that are known to cause surface cracking at different stress levels, **Figure 3**. The exact solvent and concentrations levels are specific to each resin. However, this test allows for more complex shapes to be tested and can

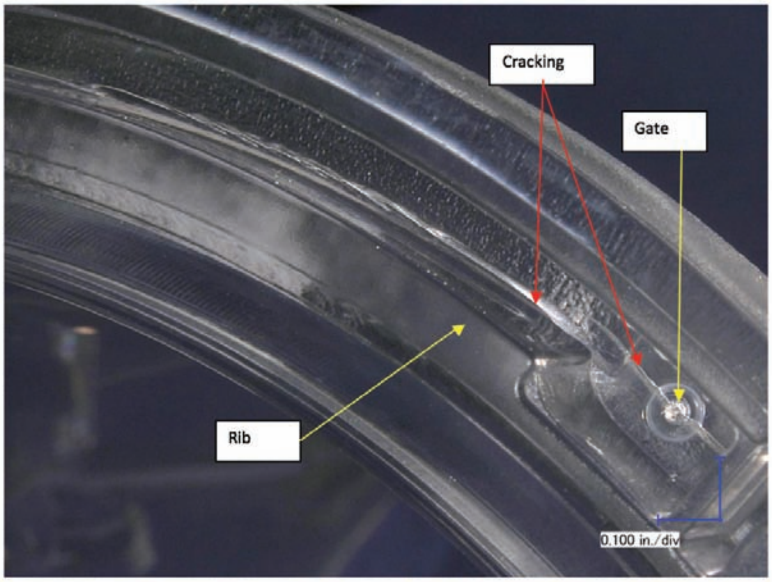

Figure 3: Micrograph Showing Cracking at the Gate and Base of Rib after Exposure to Solvent Stress Test

help provide an indication of stresses developed at thickness transitions, ribbing and bosses. It can also be an effective method at quantifying stresses near the gate of the part, and how processing may influence the localized stress in these areas.

The ability to quantify the stress state in these more complex parts, make this a nice economical method as compared to the PSA test. The limitations of this method include the fact that such a test has not been developed for every resin or polymer family, and most of the tests used are only for amorphous resins. The reason for this is that the amorphous resins are more likely to exhibit sensitivity to solvents, as compared to semi-crystalline resin. Additionally, from a practical stand point, it is easier to notice the crazing on transparent resins. Therefore, the ability to distinguish crazing at the different solvent concentrations is enhanced. Another limitation is that this method can only provide indications of the stress state at the surface of the part. It cannot directly measure the stress in the core of thick areas that may not be adequately packed out, and may be subjected to high tensile stresses.

The test can be extended to polymer blends and other amorphous resins that have not been characterized. However, development of these tests requires extensive knowledge of the material, and specimens at known stress states. The Madison Group knowledge and experience with this test method allows us to assist in evaluating and developing such test methods.

Injection Molding Simulation

The previous two methods presented focused on measuring the residual stress on physically molded specimens. Additionally, the test methods have been restricted to unfilled, amorphous resins. The last method uses a proactive approach to mitigating potential areas of high residual stress by using simulation. By using injection molding simulation, the part design and injection molding process can be analyzed and optimized prior to manufacturing any mold or parts. This proactive approach can allow the designer much more freedom, or to account for the high stress state when optimizing the design. Using simulation also allows the stress at both the surface and core of the part to be analyzed, **Figure 4**. Additionally, the stress gradient through the thickness of the part can be examined. This method allows for the high stress regions in the core of the part to be better identified and quantified. Finally, this method allows any resin part combination to be analyzed. It does not matter if the resin is transparent, semi-crystalline, filled or

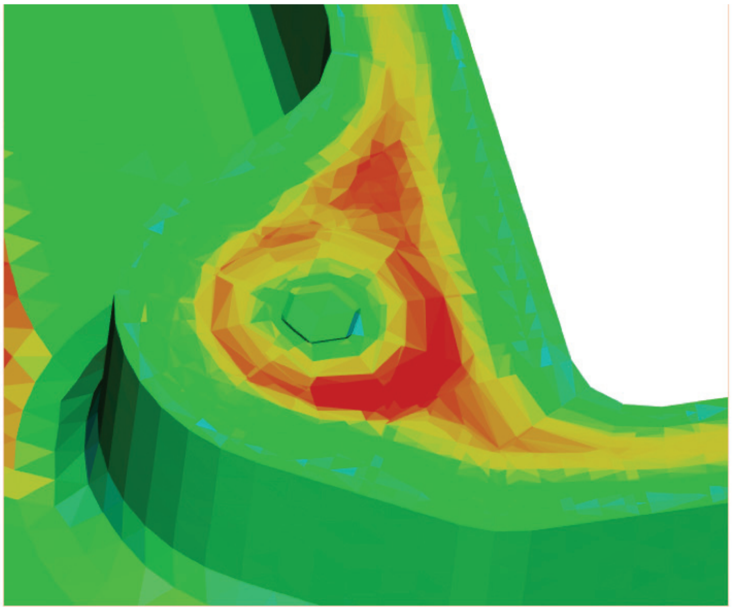

Figure 4: Predicted Residual Stress Distribution Through the Thickness of an Injection-Molded Boss Using Simulation.

unfilled. As long as the material characterization properly represents the material behavior, any material can be analyzed.

The major limitation of this method is that the stresses predicted are just that, predictions. Depending on the material characterization, or the level of detail included in the simulation the actual stress values and distribution could be different than those simulated. Additionally, the predicted stresses in thick regions that are not adequately packed out will likely overestimate the stress. This overestimation is a result of the solver's inability to create breaks in the mesh where voids may actually form in the part. Even with these limitations, the use of simulation to provide an approximation of the residual stress state in the part allows engineers and designs to make better decisions regarding material selection, part design, and processing.

As higher performance demands are being placed on plastic components, designers are forced to push the envelope of best part design and need to account for all potential sources of stress. Finding efficient and effective methods at characterizing the stress created during manufacturing can lead to better material selection, more robust part performance, and lower overall cost due to fewer part failures. While the lists provided here are not exhaustive, it can at least start the discussion on the need for such testing in the future during product validation.

For more information contact Erik Foltz at erik@madisongroup.com, or Richie Anfinsen at Richie.Anfinsen@madisongroup.com

By Omar Solorza-Nicolasa,, Hilario Hernandez-Morenob, Orlando Susarrey-Huertaa, Nestor Romero-Partidac*

Film-insert Injection Compression Molding for Reinforced Polycarbonate with Woven Glass Fiber Oriented 90/0°, ± 45 º.

Introduction

To widen the range of application for plastic materials, new polymer composites with added reinforcing materials on the plastic matrix are being developed increasingly replacing components made of metal or thick-walled plastic parts, most commonly, with short fiber glass reinforcement [1, 2]. They provide high levels of strength at extremely low weights and can be manufactured in short cycle times in large industrial quantities. Being materials reinforced with short fiber (0.2 to 0.4 mm in length, and larger fibers with lengths greater than 1mm) are affected the mechanical properties, strength, stiffness, and impact with no location of failure caused by anisotropic material due to the non-uniform fiber orientation distribution.

In the film-insert injection molding (FIM) process, the molten polymer is injected into the mold cavity where one side of the mold wall is insulated by a pre-attached film. FIM is a cost and time-effective technique eliminating various post-processing procedures (screen printing, spray painting, laminations etc.) and improving surface quality as well as durability. Many products such as automotive interior parts, cellular phone cases, logo designs on plastic products are produced using FIM method [3,4] Adhesion between the film and the substrate may be enhanced using this process as the injected hot molten resin can partially melt the film [5].

The pressure produced in this process is more uniform along the cavity wall, and lower for post filling stage, and therefore results in less residual stress as well as less part warpage [6,7] The injection compression molding differs from traditional injection molding in terms of cavity filling, where there is further melt flow and reduction of cavity volume during the packing step. The compression stage after the partial melt filling of the cavity decreases the mold pressure and clamp tonnage by 20–50%, and reduces the cycle time and residual stresses [8]

Existing studies have reported optimum material combinations for best structural performance but there is still a lack of information on polycarbonate reinforced with woven glass fiber manufactured by injection molding; therefore, this work addresses a way to expand on existing knowledge/proposals. One key aspect of this research is the introduction of woven glass fiber as reinforcement for thermoplastic polymer with fiber orientations at 0/90º and ± 45 º, maintaining the main characteristics of film injection molding , combined with compression injection molding and ensuring minimal fiber misalignment and polycarbonate degradation during process. (**Figure 1**)

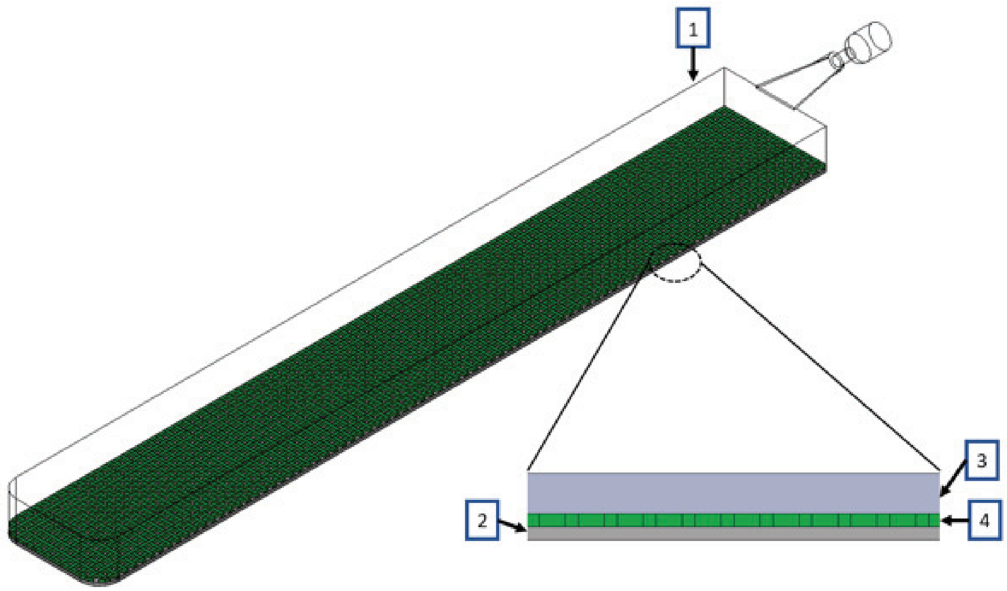

Figure 1: Components of FIM and compression. (1) Specimen of 250 x 35 mm. (2) Film of polycarbonate. (3) Polycarbonate injected. (4) Woven glass fiber oriented (90/0°, -45/45°).

Experimental

Based on the process of injection and compression, it was decided to create an insert that would be placed inside the tooling prior to injection. This insert, would be composed of a polycarbonate film adhered to a fiber oriented 0/90 and -45/45 degrees. With this the temperature of the polymer when entering the cavity, would deform the polycarbonate film in such a way that both materials adhere, allowing the fiber to remain between both materials.

Film Inserts

A polycarbonate film (Makrolon Film) of 0.85 mm thickness was laser-cut to obtain a rectangular sample with dimensions of 250 x 35 mm. The reinforced woven glass fiber with thickness of 0.38 mm, was cut oriented at 0/90 ° for one type of specimen and ± 45° for other specimens, cut in same dimension of the Makrolon film. No previous treatment was applied to the fiber.

Injection Material

Polycarbonate pellets (MAKROLON AL2407) were used as the main body matrix in this study. These pellets possess a melting temperature of 280-320 °C, a melt flow index of 19 g/10 min in rheological standard testing conditions (ISO1133), perpendicular shrinkage of 0.8 wt.% to the flow direction, and parallel shrinkage of 0.65 wt.% to the flow (ISO294-4) [9].

Method

To determine clamp force, a 3D FE analysis was performed. This model was realized with the finite element software, Moldflow. Principal characteristic is necessary for later realize studies of physical and mechanical characterization. (**Figure 2**)

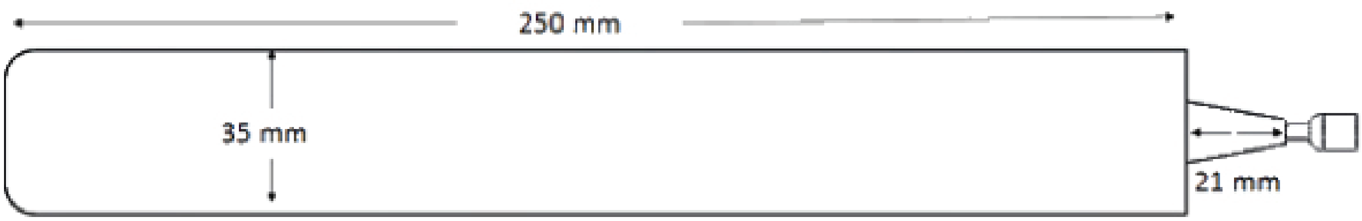

Figure 2: General dimension of specimen reinforced with woven glass fiber.

A normal filling analysis can be determined with the main equations. These equations are applicable to the flow of a polymer in the molten state and are obtained using the principles of mass, momentum and energy conservation.

$$\frac{\partial \rho}{\partial t} + \nabla + \rho v = 0 \text{ (1) Continuity}$$

Where ρ is the density, t is the time, and v is the velocity vector.

$$\rho \frac{\partial v}{\partial t} = \rho g - \nabla p + \nabla n D - \rho V \ \nabla \boldsymbol{\tau} \text{ (2) Momentum}$$

Where g is the gravity and $\boldsymbol{\tau}$ is the shear stress.

$$\rho c_p \left(\frac{\partial T}{\partial t} + v \ \nabla T \right) = \beta T \left(\frac{\partial p}{\partial t} + v \ \nabla p \right) + n\dot{\gamma}^2 + k\nabla^2 T \text{ (3) Energy.}$$

Where T is the temperature field, Cp is the heat capacity, k is the thermal conductivity coefficient, n is the viscosity of the fluid, $\dot{\gamma}$ is the shear rate. In general, this three equations will be needed to provide and accurate analysis.

As the first point, the analysis was determined, which is an injection-compression analysis. The point of injection was in the initial part of the piece, so that the mesh was made from that node, the type of mesh was different in nozzle, because it was determined that this part is considered as a hot injection system and then a refinement was made in the gate to analyze how flow front can affect orientation of woven glass fiber as shown in **Figure 3**.

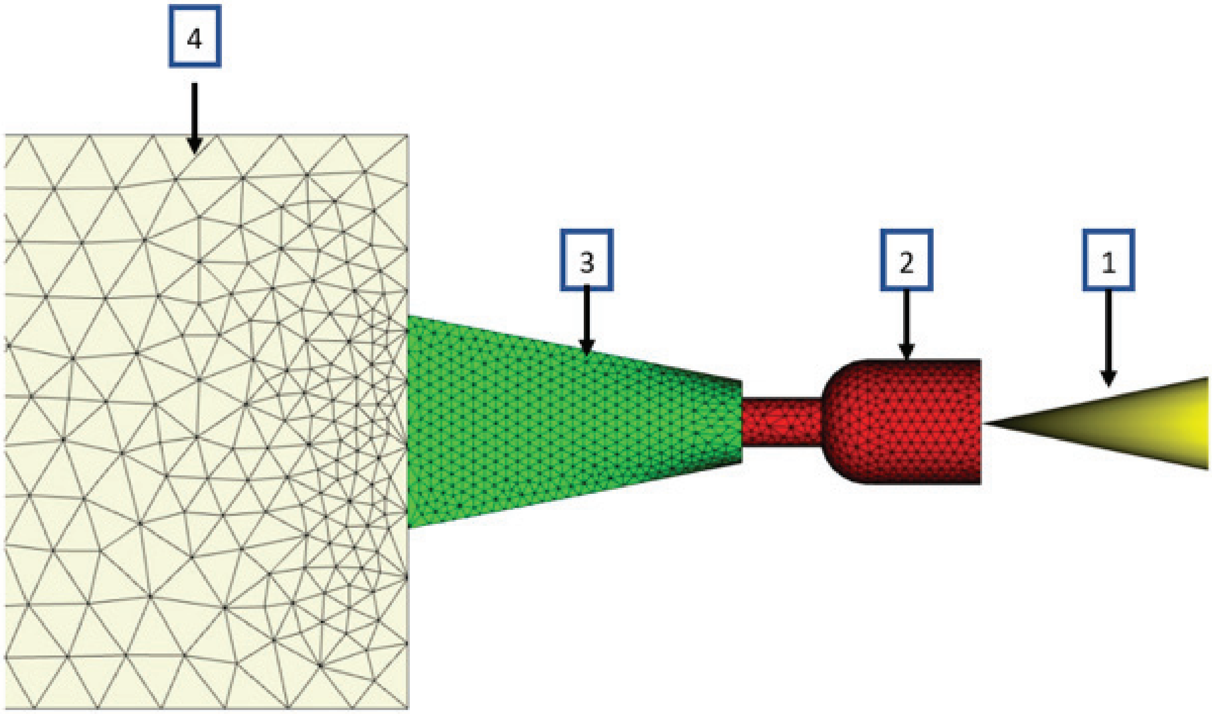

Figure 3: Section view of type of mesh used for injection, compression molding. (1) Injection location, (2) Hot runner, (3) Fan gate, (4) Specimen part

For melt flow, a fan gate is used to slow the melt as it enters to the male part, the benefits of slower the flow, improved melt orientation and reduced the chance of jetting, which affects the result of mechanical properties of the specimen.

Table 1 shows the initial conditions and **Table 2** the meshing values of the piece are shown once the 2D mesh is repaired and then the 3D meshing is carried out.

After numerical simulation a mold was designed and manufactured to be used as a film insert and injection compression mold, for a vertical injection molding machine (Battenfeld PLUS 350/75). The male part consists in a small cavity to hold the film insert during injection process, no fixing mechanism is used for film insert,

Table 1: Initial Conditions

Volume total.	22.62 cm3
Material	PC (Makrolon Al2447 Covestro)
Volume of specimen.	.04 cm3
Volume to fill.	22.82 cm3
Volume of specimen.	21.8281 cm3
Injection temperature.	320°C
Mold temperature.	100 °C
Volume of gate.	0.34 cm3
Injection time.	1.6 seg.
Projected area.	89.19 cm2

Table 2: Mesh

Type of mesh.	3D Tetragonal
Layers.	8
Nodes	12176
Injection points	1
Nodes on injection location.	1
Number of elements	61916
Tetragonal Elements	55493
Elements in hot runner	6423

the space between the male part and female part permit melt polycarbonate to continue flowing during compression stage, and also to released specimen with no using ejector pins. For compression, two single hydraulic cylinders were used. The female part, consist of a straight surface for preventing flashing in the specimen during compression stage; a hot runner system was employed in the female part, to maintain temperature of the polymer in 110ºC, this allows the melt to be at lowest viscosity with no temperature degradation when it reaches the cavity and allows polymer to flow during compression stage. The mold temperature was controlled with a water mold cooling peripheral system, for preventing heat exchange between the mold and the injection machine.

The polycarbonate pellets for injection were conditioned previously on a drying machine for 4 hours before process. And the mold was prepared setting the hot runner system temperature in the female side at 110 ºC, and cooling system at 85ºC. The film insert (polycarbonate film and woven glass fiber) was placed while mold was opened. The mold closed with clamp force of 31.15 kN in 4.95 seconds, and injection pressure set on 1094 bar during 1.6 seconds, at that point compression started with two simple hydraulic cylinders (50kN) over 10 seconds to complete filling and compress the polycarbonate until the cooling stage is over.

Results

Once the simulation was carried out, the tooling for injection and compression was made, the tests were carried out to obtain the compound. It is worth mentioning that this process was not the only option for which this compound was wanted. Within those options was the compression and injection process with no good results.

Figure 4: Degradation of polycarbonate and misalignment cause for flow advanced.

Process Justification

Injection tests were carried out, showing defects as shown in **Figure 4**, where degradation of the material can be seen due to the residence time in the injection unit and a lot of distortion of the fiber caused by the drag that caused the polycarbonate when entering the cavity.

Another defect shown in the injection process was the poor impregnation because the polymer did not completely cover the glass fiber as shown in **Figure 5** . On the other hand, the thickness of the specimen was very high as shown in **Figure 6**, the process was not constant, so it was decided to modify the process.

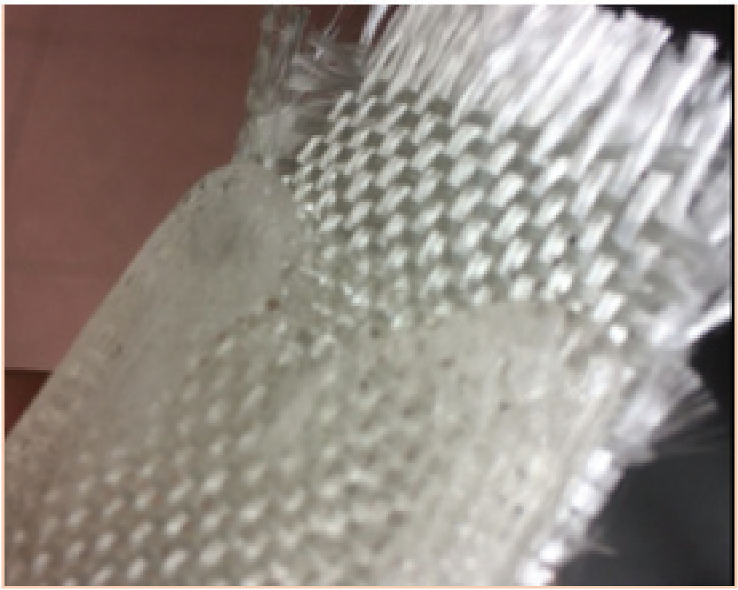

Figure 5: Bad impregnation during injection.

Figure 6: Very high thickness.

Simulation Results

In this section, the results of the numerical simulation are shown to determine if the injection machine and pistons remain within the range of operation required to obtain the glass fiber reinforced polycarbonate plate.

Figure 7 shows the pattern of filling and compression of the piece, it is seen that at the beginning the pistons are retracted, so the initial volume inside the cavity is greater, until the piece is compressed.

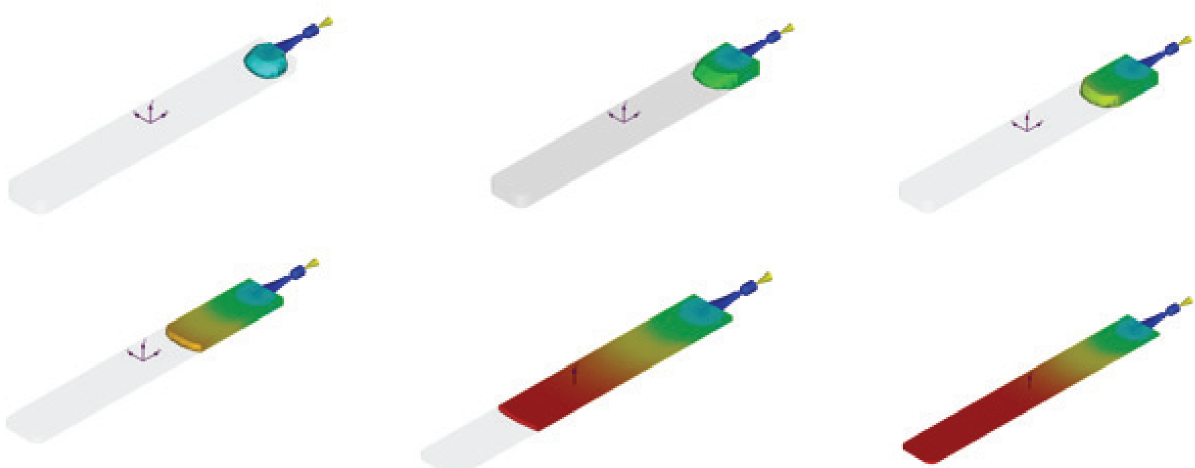

Figure 7: Filling and compression pattern.

Table 3: Simulation Results.

Total mass	23.3219 g
Specimen mass.	23.3260 g
Gate mass.	0.3759
njection pressure.	14.98 Mpa.
*Clamp force.	12.19 Toneladas.
Swicth over.	1.67 segundos.

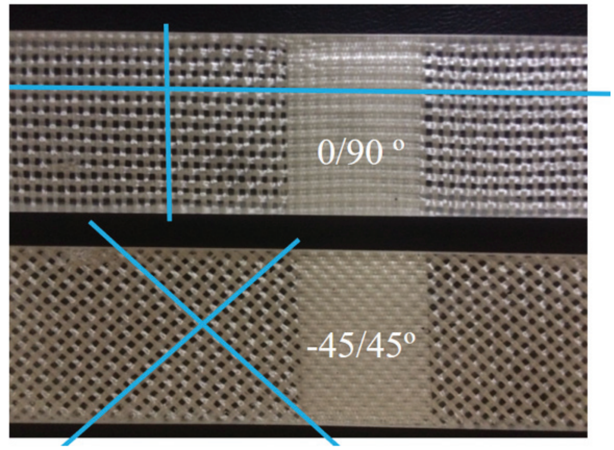

Figure 8: Visual inspection of polycarbonate reinforced with woven glass fiber oriented in 0/90° and -45/45°.

As results of the simulation, the following values were obtained, as shown in **Table 3.**

FIM and Compression

Once the tests were done and discarding the injection process, the inserts were made, creating an adjustment between the cavity and said inserts, this with the purpose that the fibers were completely immovable allowing the flow of the polycarbonate without altering the orientation of the fiber. As shown in the figure 8, the orientation of the fiber with respect to the injection process was greatly improved at first sight. **Table 4** and **Table 5** show the measurements made with a goniometer.

Table 4

Results for fiber orientation θf in degrees for 0/90º specimens.

Specimen	P1-0-90º		P2-0-90º		P3-0-90º		P4-0-90º		P5-0-90º	
1	0,00	90,00	0,00	90,00	3,00	90,00	3,00	91,00	0,00	89,00
2	0,00	90,00	0,00	90,00	3,00	92,00	4,00	89,00	0,00	89,00
3	0,00	90,00	0,00	90,00	3,00	91,00	4,00	93,00	0,00	90,00
4	0,00	90,00	0,00	90,00	4,00	91,50	5,00	92,00	0,00	91,00
5	0,00	96,00	0,30	90,00	4,00	90,00	6,00	93,00	0,00	89,00
6	0,00	94,00	0,40	90,00	2,60	90,00	5,00	93,00	0,00	91,00
7	0,00	94,00	0,00	90,00	4,00	90,00	5,00	93,00	0,00	91,00
x	0,00	92,00	0,10	90,00	3,37	90,64	4,57	92,00	0,00	90,00
s	0,00	2,58	0,17	0,00	0,60	0,85	0,98	1,53	0,00	1,00
CV	0,00	0,03	1,73	0,00	0,18	0,01	0,21	0,02	0,00	0,01

Averaged Values	PT-0	PT-90
xT	1,61	90,93
sT	0,43	1,01
CV_T	0,27	0,01

Table 5
Results for fiber orientation θf in degrees for ± 45 specimens.

Specimen	P1-45º		P2-45º		P3-45º		P4-45º		P5-45º	
1	44,00	-45,00	43,00	-41,00	41,00	-42,00	37,00	-45,00	44,00	-42,00
2	44,10	-44,00	43,00	-41,00	41,00	-42,50	37,00	-46,00	44,00	-42,00
3	42,50	-42,00	43,00	-40,00	43,00	-42,00	38,00	-47,00	45,00	-42,00
4	44,00	-42,00	43,00	-42,00	45,00	-42,00	38,00	-47,00	45,00	-42,00
5	46,00	-44,00	40,00	-42,00	42,00	-42,00	39,00	-48,00	45,00	-43,00
6	46,00	-43,00	40,00	-41,00	45,00	-42,00	39,00	-48,00	44,00	-43,00
7	46,20	-43,00	41,00	-40,00	45,00	-42,00	40,00	-47,00	44,00	-44,00
x	44,69	-43,29	41,86	-41,00	43,14	-42,07	38,29	-46,86	44,43	-42,57
s	1,40	1,11	1,46	0,82	1,86	0,19	1,11	1,07	0,53	0,79
CV	0,03	-0,03	0,03	-0,02	0,04	0,00	0,03	-0,02	0,01	-0,02

Averaged Values	PT +45	PT -45
xT	42,48	-43,16
sT	2,60	2,23
CV_T	0,06	-0,05

Discussion

The polycarbonate is degraded due to the residence time of the material inside the injection unit, this is because when placing the polycarbonate film with the fiberglass, it is complicated to carry out manually and considering that there is no a fastening system, it does something complicated.

The temperature of the polycarbonate could not be below 320, because it did not allow the advance of the flow during the compression stage, which is why it was found that one of the polycarbonates that withstands the temperature of 320-325° was Makrolon.

During the simulation, values could be obtained that agree with the physical characteristics that were counted, such as pistons and injector machine. However, in the simulation, the partial or total adhesion etween the two types of polycarbonate cannot be determined. Another important factor with which simulation does not count, is how to determine the orientation of the fibers oriented during the injection and later the compaction. It is worth mentioning that this factor was determining on foot machine and making several settings to obtain the desired results.

Specimens of polycarbonate reinforced with 4% of woven glass fiber at 0/90°and ±45° orientation have demonstrated small fiber orientation distortion. For the case of 0/90° specimens, the maximum deviation is show in the specimen with 2.58º that represent a misalignment cause by compression stage where injection flow is getting cooler, which also happened in 0º where the maximum standard deviation is 0.98º. These figures demonstrate that film injection and compression molding for the process used is controlled and few distortions is evident. Specimens at + 45° have a standard deviation of 1.86°, and for fibers at -45º have a value of 1.11°.

From the measurements for the +45 fibers, the standard deviation is 2.60° and 2.23° for -45º, those values are bigger than the values obtained for each specimen, one possible reason is a small fiber deviation due to the preparation of the film insert, but a less controlled repeatability due to manual skills needed. In general, the misalignment of the sample is small, and a small fiber misalignment is concluded for the film injection and compression process.

Conclusion

Traditional methods of injection and compression, are not feasible to reinforce the polycarbonate with glass fibers, this because the fibers lose their desired alignment. Some of the traditional processes such as thermoforming and compression have shown that there is no complete adherence between fiberglass and polycarbonate.

In this article it was demonstrated that a material reinforced with fiberglass can be obtained, without having to chemically attack the fiber previously. As future research, the physical and mechanical properties of the material must be obtained to determine if an improvement is obtained.

Acknowledgements

The authors appreciate the assistance provided by the material testing laboratory at IPN ESIME Ticomán in the development of the mechanical test, especially to Mr. David Anaya Gallegos. Also to Polimeros y Compositos S.A de C.V for providing the material, manufacturing machinery, the mold injection and the injection tests to obtain the material used for this research. Mr. Omar Solorza is also grateful to CONACYT-Mexico for their doctoral fellowship #446307.

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By Rey Parel
SPE Golden Gate Section

Prognostic Medical Devices — The Wave of the Future

Imagine a world where disease could be predicted before it happens, instead of diagnosed and cured by drugs or surgery. Where doctors could change a patient's life style, diet and exercise, and prevent the disease.

A Bishop once told me, long ago before the advent of the diagnostics revolution, that God designed the human body to produce very small amounts of antigens to signal the advent of diseases, and was just waiting for man to rise to the level of intelligence to create devices that would be able to detect these.

Flashback to 1989, when I met Kary Mullis, who won the Nobel Prize in Chemistry in 1993 for a technology called Polymerase Chain Reaction, and he said: "I want you to design a tube that is so thin and so uniform in thickness, it has never been done before in plastic!" And we asked, why plastic?

Because we will produce millions and millions of these "thermocycler tubes", and it has to be manufacturable and cheap, robust and accessible to ordinary folks. It blew our minds, because the concept of amplifying (making copies) of DNA was not only foreign to us young plastics engineers but mind-boggling in its concept.

The way he explained PCR to our "primitive" minds was like this: Imagine our DNA chain as a railroad track twisted like a helix. Under heat, this railroad track unravels into a straight track. The polymerase enzyme takes base pairs from other sections of this railroad track and puts it in the same sequence as the DNA sequence you want to copy. And it can do this hundreds, millions, even billions of times.

He said the thermocycler tube wall thickness must be incredibly uniform, so uniform in fact that it was well nigh impossible to produce with the state of plastics technology at the time.

As I said, it blew our minds! Fast forward 3 years later, and the first GeneAmp PCR System was developed and the ultra-thin, ultra-uniform PCR thermocycler tube was a reality. I certified the polypropylene material that is still used today in all your labs.

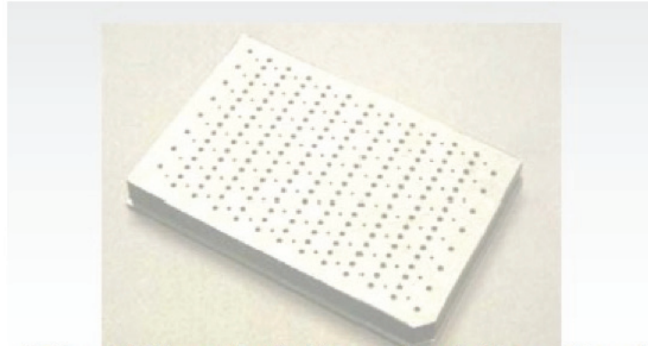
I have a Polaroid photo of myself and the Perkin-Elmer guys kicking the first box of PCR tubes out the door. One of its first applications, even before it was ever mass-produced, came about from a very tragic incident in Petaluma in 1993.

The FBI approached Perkin-Elmer and said: "We heard you have a new method for making copies of DNA. We have a very small spec of blood on the scene where a little girl by the name of Polly Klaas was abducted and subsequently murdered, and which we believe was of the perpetrator. The

First PCR Thermocylcer Tube
(Perkin-Elmer/Applied BioSystems)

spec is so minute, we can't identify it."

I have to tell that when the District Attorney held up that tube on TV and said: "This is Polly's blood!", I ran up and down my neighborhood and yelled, "That's my tube! That's my tube!" When I recount this story today, it still gives me goose bumps almost 25 years later.


First Plastic Microfluidics Card

Fast forward to 2000, when we made the very first microfluidics chip in plastic at Aclara Biosciences. Seventeen years ago, advances in materials, machinery, equipment, and software were still in their early stages to enable replication of micron plastic features. It was a struggle.

Fast forward some more to 2010, when we were using injection-compression molding technology, borne out of the CD/DVD industry and morphed by Sony DADC Biosciences for biotech applications, to mold at Illumina a credit-card sized PCR chip with 2.8 million wells, each well 30 microns in diameter. Who would have thought this was possible 25 years ago!

I tell this story about PCR because as the engine that revolutionized research to sprout new fields in DNA sequencing, genomics, bioinformatics and the like, this surging wave spurred the plastics industry to develop new techniques, new machinery, new tools, and new polymers to meet the demanding challenges of replicating increasingly smaller and smaller features.

The result was the plastic microfluidic chip embedded in almost every diagnostic medical device today.

Polymer-Based Microfluidic Chips: The Engine That Is Driving a New Generation of Medical Devices Called Prognostic Point-Of-Care Devices

The impact of the microfluidic chip in the Life Sciences is similar in magnitude to the impact of the microchip in the Information Sciences. If the microchip reduced building-size computers to the size of your hand, the microfluidic chip is reducing building-size laboratories and hospitals to the size of your thumb.

Why plastic? Consider this: It costs around $0.30 cents per sq cm for a silicon-glass chip and $0.03 per sq cm for the same chip molded in Cyclic Olefin Polymer. As Kary Mullis said, it must "manufacturable and cheap, robust and accessible" to the masses.

The push over the last 15 years is transitioning from glass to polymer substrates, because of the latter's scalability, manufacturability, lower cost and biocompatibility. Microfluidics means smaller reagent volumes (some of which can cost several hundred or thousand $ per liter), but also shorter reaction times and faster analyses results (from days in a lab, to hours or even minutes), on-site delivery of test results, smaller sample sizes (blood, cells, etc.), and greater number of iterations (from tens to several millions) – all of these translating to less cost, portability and disposability.

Hence, the development of exciting new devices such the ubiquitous Lab-on-a-Chip, the more recent Organ-on-a-Chip and Body-on-a-Chip, each about the size of your thumb or palm. All of these devices take advantage of the unique fluidic flow properties at the microfluidic level, and most if not all powered by micro pumps and valves without external power sources except capillary pressure, all integrated into the plastic design. Did I say moldable? Yes!

How these are accomplished in fact is due to a convergence of teams of researchers with inventions for advanced immunoassay devices and dense arrays (from sample prep, to amplification, to detection, to immunoassays, to sequencing) with teams of plastics engineers who have developed these new techniques

Prognostic Medical Devices — The Wave of the Future

to make their scale-up a reality.

As Healthcare moves away from curing diseases to predicting diseases via handheld POC (point-of-care) devices, the advent of the polymer-based microfluidic chip is the enabling technology that is making this happen. These new devices are called Prognostic Devices.

At the heart of these disease-predicting devices are novel developments in nano-biosensors and ultra-sensitive DNA detection.

One Example: Imagine a microfluidics-based POC device that can detect BNP, a cardiac marker antigen that is produced by the heart in very minute quantities before the advent of Arrhythmia in a patient. Then the doctor can prevent the disease by changing the patient's life style, diet and exercise.

There is such a device right now, in production by a China-based company, Micropoint Bioscience (http://www.micropointbio.cn), and was initially funded by the Chinese government, because there are 100 million people with incipient arrhythmia-risk in the Chinese mainland, many without direct access to government hospitals.

The device is called mLabs® Precision POC Testing, which is an immunoassay diagnostic platform, based on their patented microfluidic technologies and advanced fluorescence detection.

According to Micropoint's CEO, Nan Zhang, the device currently tests for D Dimer (a protein released by blood clots), but more cardiac markers are coming soon, including Troponin I (a marker for heart muscle damage), hs-Troponin I (a marker for acute thrombosis syndrome), and the aforementioned BNP.

Why polymer-based microfluidics chips? Over the last 25 years, microfluidics has been largely silicon-glass based, due to their micron-size features, which was difficult to replicate using conventional molding methods and materials.

The state of the art has finally caught up with the exacting demands of the microfluidics field. There are exciting breakthroughs in the following technologies that are enabling microfluidic chip injection molding:

(1) Conformal cooling, microstructure and microfluidic tooling
(2) Microchannel molding, dense micro-array and replication processes
(3) Surface modification and surface treatment techniques
(4) Advanced polymers and plastic materials

There are exciting developments in automation, simulation software, molding equipment, and 3D printing that have advanced in lock-step with the growth of the microfluidic chip field.

Succeeding articles will touch on these breath-taking developments and more examples of Prognostic Devices that are breaking new ground.

About the Author

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Injection Molding Division Website
injectionmoldingdivision.org

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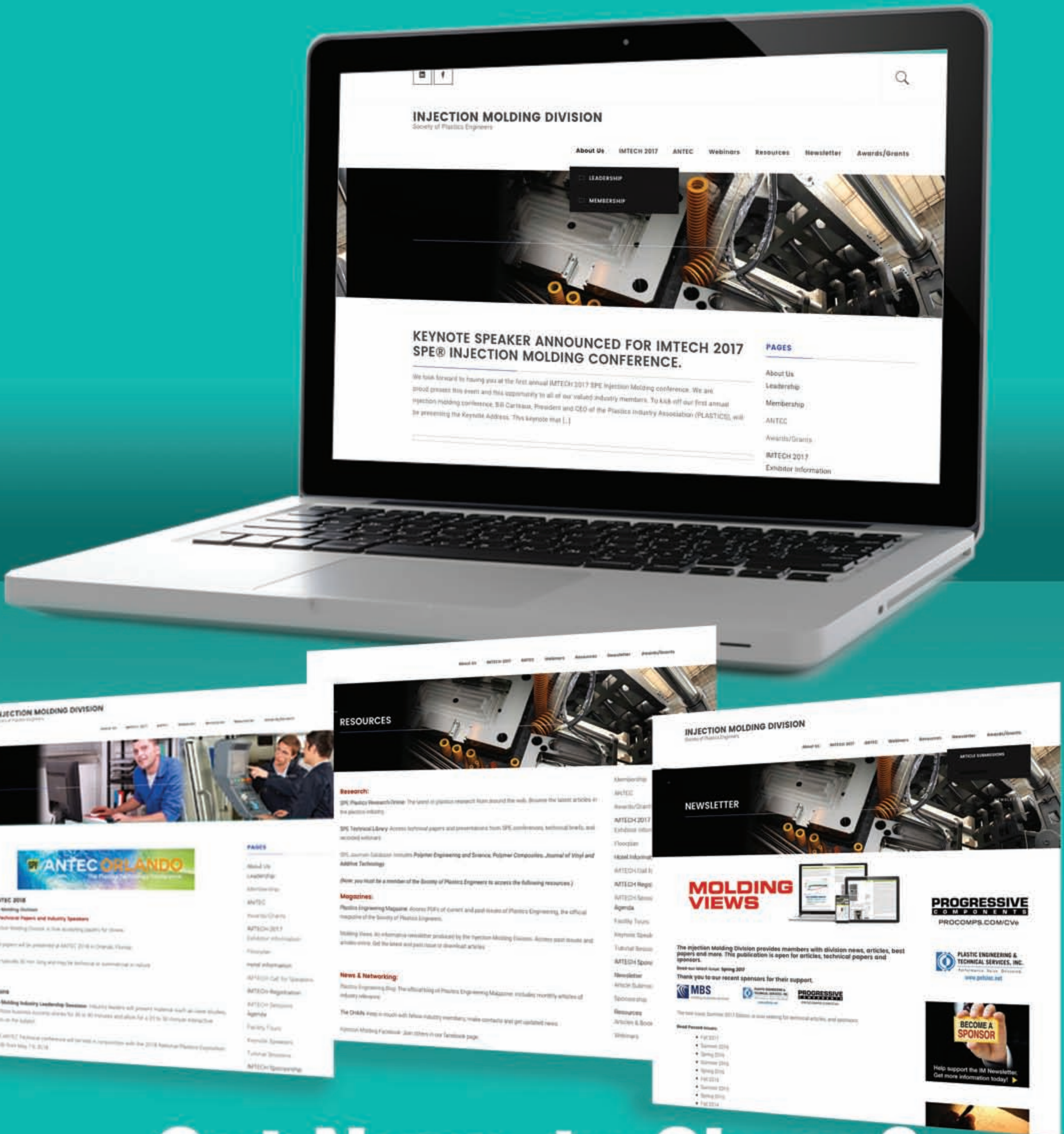

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Newsletter Sponsorship

MOLDING VIEWS

The SPE Injection Molding Division Newsletter is issued three times a year, with readership of a captive audience of professional individuals specifically involved in all aspects of injection molding.

The newsletters are made possible through the support of advertising sponsors and author support shown in the Newsletter. The Newsletter is published in Fall, Spring and Summer

The SPE Injection Molding Division Newsletter has several opportunities for companies interested in sponsors.

Sponsor Packages:

Bundle 1: $1,500/year

- Full page ad placed in 3 newsletters
- Banner ad on website for the year
- 3 company press releases for posting throughout the year on website
- Technical article published in newsletter

Bundle 2: $750/year

- Half page ad placed in 3 newsletters
- Banner ad on website for the year
- 2 company press releases for posting throughout the year on website
- Technical article published in newsletter

Bundle 3: $375/year

- Quarter Page page ad placed in 3 newsletters
- Banner ad on website for the year
- 2 company press releases for posting throughout the year on website

Author Contributor:

- Technical article published in newsletter and on website
- Contact banner ad to accompany article

IMD Newsletter PublisherIMDNewsletter@gmail.com

IMD Board of Directors Meeting

May 6th, 2018

Submitted by Joseph Lawrence

Welcome & Opening Remarks – Srikanth Pilla, Injection Molding Division Chair

Division Chair Srikanth Pilla called the meeting to order at 8:05 AM (Eastern Daylight Time, EDT) and welcomed all attendees to the Spring IMD Board of Directors Meeting. Secretary Joseph Lawrence called roll at 8:07 AM (EDT).

Roll Call – Joseph Lawrence, Secretary

Present in person and via WebEx & MML/Teleconference:

Vikram Bhargava, Jack Dispenza, Jeremy Dworshak (Executive Committee VP), Erik Foltz, Nick Fountas, Brad Johnson, Pete Grelle (Technical Director), Adam Kramschuster, David Kusuma, Joseph Lawrence (Secretary), Ray McKee, Kishor Mehta, Susan Montgomery (Councilor), Lynzie Nebel, David Okonski, Sriraj Patel, Hoa Pham, Srikanth Pilla (Division Chair), Rick Puglielli (ANTEC 2018 TPC), Tom Turng, Chad Ulven, Mal Murthy, Edwin Tam, Stephanie Clark (Invited Guest), and Vijay Simha (Invited Guest).

The participation of the official IMD Board Members constituted a quorum.

Absent were:

Alex Beaumont, Jim Wenskus (Treasurer) and Angela Rodenburgh.

Notes:

Invited guests Stephanie Clark, Senior Director, Sale & Advertising, SPE and Vijay Simha, President & CEO of Akuva Technologies were introduced by Srikanth Pilla to the IMD Board of Directors.

Approval of the January 19th, 2018 Meeting Minutes

The meeting minutes from the Tupperware Board Meeting of January 19th, 2018 were presented. No changes were made.

Motion: Pete Grelle made a motion to approve, Edwin Tam seconded, and the motion passed at 8:11 AM (EDT).

Nominations Committee Report – Hoa Pham, Nominations Chair

Hoa presented the ballot results with total 12 votes. David Okonski, Jeremy Dworshak, Erik Foltz, Alex Beaumont, Chat Ulven and Angela Rodenburgh were listed in the ballot. It was discussed that the entire board members did not vote. It was suggested to send reminder emails during the voting so that people do not lose the email. There was a discussion on whether to approve the voting results or to pass a motion. The voting results were approved.

IMD Board of Directors Meeting Continued

Hoa presented to the Board of Directors a list of Officers 2018 – 2019 (ending at ANTEC 2019)

1. Chair	Srikanth Pilla
2. Chair-Elect	Rick Puglieli
3. Past Chair	Raymond McKee
4. Treasurer	Jim Wenskus
5. Technical Director	Peter Grelle
6. Secretary	Joseph Lawrence

Re-elected Board of Directors (term ends at ANTEC 2021)

David Okonski
Jeremy Dworshak
Erik Foltz
Chad Ulven
Angela Rodenburgh
Alex Beaumont
Councilor 2017 – 2020: Susan Montgomery

Hoa finished by confirming the following information for the ANTEC Technical Program Chair (TPC):

ANTEC 2018 TPC is Rick Puglielli
ANTEC 2019 TPC is David Kusuma
ANTEC 2020 TPC is David Okonski
ANTEC 2021 TPC is Joseph Lawrence
ANTEC 2022 TPC is Chad Ulven
ANTEC 2023 TPC is Raymond McKee

ANTEC 2018 Technical Program Chair (TPC) Update – Rick Puglielli, ANTEC 2018 TPC

Rick Puglielli presented the session matrix to the board and discussed the bios for the moderators. He suggested to maintain the start time of all sessions in case a speaker did not show up on time. The joint session with medical plastics on Tuesday was mentioned. A discussion happened on the terrible App versus the printed program. Edwin Tam insisted on printed program. Improvement for next year includes a new software for TPC to manage the papers and bios. It was discussed that the papers need to be finalized earlier for next year with ANTEC 2019 being advanced to March instead of May.

David Kusuma presented an update on the ANTEC 2018 reception to be held at OCCC room W308 (West Building, Level 3), from 6:00 PM until 10:00 PM. He discussed about the room and table layout. All the sponsors were mentioned and discussed and he suggested to greet them and thank them for their sponsors. Srikanth Pilla asked about the industry versus non-profit sponsors and David Okonski explained the different rates for each level of sponsors. Expense total for this year including food and bar was $17,085.75, on target. Last year was expensive around $22,000 due to California location. Special thanks for David Okonski as sponsorship chair to raise $21,000 this year. David Okonski will hang banners and posters to advertise the reception at ANTEC. After discussion, it was decided to allow ANTEC registrants to attend the reception and not allow the NPE registrants. Also, 1 guest was allowed for drink tickets along with an ANTEC attendee. Edwin Tam and

IMD Board of Directors Meeting Continued

Joseph Lawrence volunteered to be greeters. Dave Okonski presented the banner and thanked Heidi Jensen for her support in making the banners and website. Thanks Heidi!

Technical Director Report – Pete Grelle, Technical Director

Technical Director Pete Grelle presented data on ANTEC papers from 1992 to current year. He thanked Rick Puglielli for his outstanding job on putting together papers for ANTEC 2018. Pete broke down papers into 3 categories; Academic, Industry and Joint (Academic & Industry). This year we are down to 34 papers. There were 24-25 academic papers, 4-5 from industry and 4 joint papers. Pete Grelle presented various demographic data based on countries around the world and also showed the split for Asia. It was noted that the papers from US dropped from 37% percent from ANTEC2016 to 9% in ANTEC2018 which is a cause for concern. The papers from Europe were 34% and from Asia were 36%. While papers from Europe and Asia remained the same compared to last year, the papers from Australia went up. Within Asia, majority of the papers came from Taiwan and did not see any paper from India this year. Germany had 75% share in the Europe demographics. A discussion was followed about the way papers are published in ANTEC and fee for presenters. Because of these reasons we may have less papers. Other factors affecting SPE papers may be due to other growing areas such as 3D printing and bioplastics as well as difficult approval process in the industry legal system.

The paper quality index and the new paper review form implemented for this year's ANTEC was presented. The quality of papers went up and this year was the highest at 70% APQ index. Pete Grelle presented the 2nd quarter schedule of 2018 SPE Detroit section AutoEPCON, NPE/ANTEC 2018 and 18th International Polymer Colloquium in Madison, WI. No events are scheduled for 3rd quarter and IMTEC conference in 4th quarter in Cleveland Marriott East from November 6th to 8th. There was no injection molding session at his year's Auto-EPCON. David Okonski mentioned that the profit from AutoEPCON this year will be less than $10,000 due to NPE being this year after one week of AutoEPCON. Impact of NPE on AutoEPCON was discussed. Brad Johnson commented that the Colloquium had 60-100 people and discussion was good on fiber reinforced plastics, injection and compression molding on short fibers.

David Okonski suggested that for IMTEC 2018, we will come in on the 5th and setup so that conference will kick off on November 6th. We need to reach the metric on sponsorship for IMTECH or cancel by August 1st. Approximately $60,000 in sponsorship is needed to conduct IMTECH. Need to put IMTECH information on website by end of this week. Due to NPE, budget is tight and David Okonski talked to headquarters, working with division, medical molding to kick off the papers for IMTECH. He also mentioned about partnering with the Cleveland section with appropriate revenue split. The technical sessions matrix for IMTECH was showed by Pete Grelle and he solicited help for moderators for each sessions and volunteers. Adam Kramschuster suggested that the moderator's matrix will be filled after the board meeting. The conference format will remain the same as last year.

Pete Grelle then proceeded to provide an update on the Injection Molding Webinar Series and TOPCONs. Pete concluded by presenting a matrix of 2019 and 2020 schedules.

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

No new updates were provided by Rick Puglielli. The minutes of last meeting and articles need to be sent to Heidi Jensen for the newsletter. The website locked out temporarily and everything seems to be working now. Adam mentioned that any updates to be sent to him so that it can be put on the website.

IMD Board of Directors Meeting Continued

Membership Report – Erik Foltz, Membership Chair

Membership Chair Erik Foltz informed the Board that current membership stands at 2,172 which is slightly down. There is a new class called affiliate member. It appears that "drops" and "adds" are at steady state. Erik believes that there is a boost during ANTEC. We are a large division and we need to recruit the new class of people under 40. Strategies to improve membership numbers were discussed. The headquarters' SPE is ME campaign was discussed and redesign of the IMD website was suggested. We will introduce a membership campaign for IMD called IM SPE with goals to add faces to show diversity. Erik reached out to 50 IMD members for testimonials and heard back from 25 individuals who agreed to contribute and allow us to use their testimonials. The goal is to give potential members a visual indication of similar background members. Different ways to increase student members were also discussed.

HSM & Fellows Update – HSM & Fellows Chair Tom Turng

Tom did not present, instead Srikanth Pilla presented the updates. The IMD nominee is Prof. Carol B. Barry of UMass Lowell, got elected to SPE Fellow. We look forward to receiving suggestion about Fellows and HSM. Next year, we plan to nominate Prof. Amar Mohanty and Prof. Christian Hopmann of IKV for SPE fellows. Vikram Bhargava suggested Mr. Suhas Kulkarni to be nominated for Fellow and the current criterion for Fellow was discussed.

Action Items: Pete Grelle to provide information regarding his suggested HSM candidate to Tom Turng and Vikram Bhargava to check with Tom Turng to be on the Fellows selection committee

Education Committee Update – Srikanth Pilla, Chair

Srikanth Pilla suggested to host a YouTube Channel for education. Srikanth volunteered to be the moderator for the YouTube channel. Advertisement were discussed. Lindsey suggested to have basic content on the YouTube channel for students and young professionals. Srikanth suggested to upload the IMD web series with consent from the speakers. Ray Mckee suggested to create a committee to go through the scholarships. Srikanth called for nominees; Lynzie Nebel, Ray Mckee, Vikram Bhargava, Jack Dispenza, Srikanth Pilla and Adam Kramschuster were announced as the education scholarship committee. Ray Mckee will take the lead on the scholarship committee.

Action Item: Srikanth Pilla will setup the YouTube Channel for education and moderate the channel.

Councilor Report – Susan Montgomery, Councilor

Councilor Susan Montgomery was unable to attend this Board meeting but did submit a report to Division Chair. Srikanth Pilla presented the councilor report to the board and said that Susan's presentation will be available for anyone in the board to review.

New Business & Round Table – Srikanth Pilla, Division Chair

Srikanth Pilla thanked David Okonski for his outstanding job on Sponsorship. Excellent work David! Lynzie Nebel and Susan Montgomery accepted to be part of the new sponsorship committee. Stephanie Clark (invited guest) from headquarters presented a proposal to raise sponsorship for the division and provide sales support. Questions were raised by the board members on the fees which was 30% for new revenue and 15% for renewal revenue. After extensive discussion on this topic, no decision was made regarding the sales support proposal presented by Stephanie and the board members decided to have closed room discussion.

IMD Board of Directors Meeting Continued

During the closed room discussion, it was decided that the sponsorship committee will help to raise sponsorship for IMD and David Okonski will continue to help and provide advice to the committee members. Sriraj Patel and Edwin Tam volunteered to be on the sponsorship committee in addition to Lynzie Nebel and Susan Montgomery. The new committee with Sriraj Patel as interim chair will work on securing sponsorship for IMD.

Motion: Srikanth Pilla moved to formalize the sponsorship committee, Vikram Bhargava seconded, and the motion passed at 11:58 PM (EDT).

Action Items: Sriraj Patel (Interim Chair of Sponsorship Committee) will present a scope for the committee in the next board meeting. Kishore Mehta will write the bylaws for this committee.

Srikanth Pilla proposed to form a committee to select an outstanding young engineer award for <35 years of age during IMTECH conference. Eric Foltz suggested to keep this under Tom Turng and not form a new com-***mittee. Tom will delegate this responsibility as needed.***

Motion: Srikanth Pilla moved to create a new outstanding young injection molding engineer award (name will be formalized by Tom Turng), Edwin Tam seconded, and the motion passed at 12:03 PM (EDT).

Vikaram Bhargava mentioned that this will be the last board meeting for Nick Fountas and Mal Murthy. The board applauded and appreciated the great service. Thank you Nick and Mal! Mal Murthy and Nick Fountas mentioned the challenges that the board will face in the coming years and commended that the board is in good shape and it will carry on its mission. Adam Kramschuster congratulated Ray McKee for his 2 years of service as the division chair.

Adjournment – Srikanth Pilla, Division Chair

Motion: Adam Kramschuster made a motion to adjourn the meeting. Ray Mckee seconded, and the motion passed. The meeting was adjourned at 12:09 PM (EDT).

The next meeting will be a conference call. The date and timing will be communicated by Srikanth Pilla (Division Chair).

Respectfully Submitted by (Incoming) Secretary Joseph Lawrence

OUTSTANDING YOUNG INJECTION MOLDING ENGINEER AWARD (OYIME)

AWARD DESCRIPTION

The Society of Plastics Engineers-Injection Molding Division (SPE-IMD) is announcing a new award to recognize young engineers who are in the injection molding industry, the Outstanding Young Injection Molding Engineer Award. This new award recognizes injection molding engineers, age 35 or younger, who have made exceptional contributions and accomplishments in the molding industry.

Nominees are selected by the SPE-IMD's Awards Committee based on a single outstanding accomplishment including technical, leadership, management, or for several significant accomplishments in one or more areas of activity. The impact of these accomplishments should be recognized beyond the nominee's own company.

NOMINATION ELIGIBILITY & REQUIREMENTS

- Age 35 or younger on October 1 of the year of their nomination
- An engineer or technologist

Note: SPE membership is not a requirement for nominees.

To submit an Outstanding Injection Molding Engineer Award nomination:

- Verify that the nominee meets all necessary eligibility requirements outlined above and on the nomination form. Note: The Award is open to both U.S. and international citizens.
- Submit a one-page nomination letter that includes nominator's intent to recommend the nominee, significant technical, leadership or management activities/achievements of the nominee. Note: Self-nominations and/or submissions are accepted.
- Include a personal one-page letter highlighting nominee's self-assessment of their career as well as a vision on the future of injection molding field.
- Include one strong, broad-based letter of recommendation, preferably by the nominee's immediate supervisor. *Note: This is different than nominator and the letter has to be on referee's letterhead.*
- Enclose the nominee's CV (Curriculum Vitae) or resume. All nominations must include one of these forms of career histories.

Send the nomination letter, personal letter, recommendation letter and either a resume or CV no later than 5pm EST, **December 15 2018** to:

Ms. Lynzie Nebel, OYIME Committee Chair, SPE Injection Molding Division
Email: lynzie.nebel@gmail.com

IMD Leadership

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IMD New Members

The Injection Molding Division welcomes 82 new members...

United States

Isaac Sims	
Jill Jacobson	McDunnough Inc
Hector Figueroa	BADGER METER
Travis Hancock	Matrix Manufacturing
Victor Mendoza	BADGER METER
Robert Haley	Aero-Plastics
Scott Wahl	PCS-Company
BJ Broderick	Trademark Plastics Corp.
John Evans	Prism Plastics, Inc.
Gregory Pigeon	UMass Lowell Plastics Engineering
Ann Boland	
Kerry Garringer	Micro Interface Design
Thomas Goth	Clearview Design & Mfg
Alesha Schonthaler	Penn State Behrend
Ryan Nadel	Charlotte Pipe and Foundry Co.
Andreas Moll	KraussMaffeis
Monica Weiss	
Brett Cleary	Manner Polymers
Laurie Lawin	Minnesota Rubber & Plastics
Jason Desotell	
Jake Grunewald	MRIGlobalPlastics
Ben Jones	Steinwall, Inc.
Josh McKay	MRIGlobalPlastics
Nick Smearman	MRIGlobalPlastics
Joe Stamm	4front Manufacturing
Jeff Davison	InMold Solutions
Rick Glesner	SEDLOCK Companies Inc
Max Cummings	Teel Plastics
Dhanachezhian Duraikannu	
Inna Lempert	
Lauren Jacky	CONMET
Trevor Westbrook	M. Holland
Matthew Williams	Adams Engineers & Equipment
Tyler Thiel	HellermannTyton
Jim McQuown	STIHL
Ayush Bafna	The Dow Chemical Company
Brian Swain	PlastiWin Capital Equipment, LLCs
Dustin Miller	Whirlpool
Arul Subramanian	Lab126
Enmin Wang	Provivi Inc.
Bennett Howard	Sodick Injection Molding Machines
Shana Bemer	Panduit Corp
Alicyn Rhoades	Penn State Behrend
Caleb Schultz	Vantage Plastics
Steve Rogers	TRINSEO
Dan Regovich	AJ Augur Group, LLC
Ethan Rehor	Syntec Optics
Jeff Sanders	RJG
Austin Hines	UMass Lowell
Celso Ramirez	UMass Lowell
Gavin Shepherdson	Whelen Engineering Company
Joseph Gardner	Ametek
KennethStewart	Plastics Color Corporation
Christopher Jackson	Henniges Automotive
Todd Lamb	Trinseo, LLC
Paul Pearson	Rehrig Pacific Company
Shaun Stelley	National Instruments
Jessica Boyer	Covestro
Clay Reber	Diassess
Jason Murphy	Next Chapter Manufacturing
Kelly Knake	Impac Systems Engineering

International

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Pritpal Tiwana	Rode Microphones	Australia
JoAnne Thompson		Canada
Péter Pálfi	EPCOS Kft.	Hungary
Ankit Pancheriwala	Bajrang Prestressed Products Pvt.ltd	India
Ankur Jindal	Jindal Plastics Enterprises	India
Kelvin Dadhania	Survey No.108/p, Near Toll Plaza,	India
Manishkumar Patel	Duke Plasto Technique Pvt. Ltd.	India
Periwal Mukund	Pinoeer Syntex	India
Rahjat Jindal	Jindal Plastics Enterprises	India
Sanmay Dasgupta	Moog Motion Controls(P) Ltd.	India
Santhosh Kumar Garapati	Indian Oil Corporation Ltd.	India
Vijay Jamnik	Jindal Polyfilms Ltd.	India
Lorenzo Sammassimo		Italy
Marco Sorgato	University of Padova	Italy
Riccardo Berti		Italy
Sadiq Al-Lawati		Oman
Meng Shu Han	Sodick Singapore Pte Ltd	Singapore
Miguel Angel	Leon AIJU	Spain
Mohamed Azougagh	Lyondellbasell	United Arab Emirates

Message from the Publisher

I hope you enjoyed this issue. I'd like to congratulate some of our board members Jim Wenskus for receiving the 2018 Injection Molding Division Lifetime Achievement Award. A very dedicated person who is well desirved of this recognition. And welcome Srikanth Pilla as the IMD chair.

Our next issue will be this Fall and the newsletter is seeking support with technical papers, articles and sponsors.

If you have a paper you would like to share you can e-mail your submission.

I hope everyone enjoys the rest of the summer and see you in the fall!

Heidi Jensen
PublisherIMDNewsletter@gmail.com

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

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