spe INJECTION MOLDING
Injection Molding Division
Molding Views

Spring 2023 | No. 119 www.injectionmoldingdivision.org Keep the connection! Join us on:

Chair's Message David A. Okonski

Division Membership & Fellow SPE Colleagues,

It's Spring!! Clocks have been adjusted to daylight savings time, and the snow in Michigan's lower peninsula is gone. My snow skis have been put away until next December, but the water skis are coming out of storage. Spring also signals the start of the SPE conferencing season with lots of exciting technical programs being offered now through November; case in point, I just returned from Denver, Colorado where I attended ANTEC® 2023.

The ANTEC® format changed this year; so, I wasn't really sure what to expect. Presentations were categorized by theme: Plenaries, Advances in Materials & Characterization, Digitalization & Additive Manufacturing, Polymer Processing & Equipment, and Sustainability. There was also a symposium (Dr. Shaw's Symposium) and student posters. As with all ANTEC's, there were concurrent sessions, and the five hundred or so attendees had to be very selective as to which presentations they viewed in person. I, of course, focused my attention on the injection molding content that was part of the Polymer Processing & Equipment Sessions. The Injection Molding Division (IMD) was responsible for two half-day sessions with each session having six presentations; the two moderators were fellow IMD Director Tom Turng and myself. I was pleased with the technical content of each and every presentation and also pleased that in person attendance was about 45 people for each talk – a true statement even for the last presentation on the last day of the conference which is amazing. In retrospect, ANTEC® 2023 was a particularly good event with good technical content and ample networking opportunities.

Your next opportunity to engage with the IMD is coming on May 2nd at the SPE Auto EPCON Conference being held at the Detroit Marriott Troy located in Troy, Michigan. The 2023 conference theme is "Engineering Plastics for Future Mobility". I co-chair the event on behalf of the SPE Detroit Section and worked with IMD ANTEC® 2023 Technical Program Chair Ray McKee to include injection molding content in the Simulation Session; other sessions include: Additive Manufacturing, Sustainability, Materials, Flame Retardant Materials for E-Mobility, and Electrification. Auto EPCON is a great one-day conference that deals with thermoplastic as well as thermoset material systems. Please visit the conference website (Auto EPCON 2023 Conference | SPE (**4spe.org**)) for more detail as well as for registration. Please don't miss this opportunity to learn something new and interact with industry professionals. I'm looking forward to seeing you in Troy, Michigan.

On a personal note, this is my last Chair's Message as I pass the gavel to Jeremy Dworshak on July 1st. I extend my best wishes for success to Jeremy as he leads the IMD in the next fiscal year. This is also the last time I address the IMD as a General Motors employee; after 39 years, I have decided it is time for a change in scenery. I am not sure what my future looks like, but I am excited for the next chapter in my life's story.

Best Regards to All,
David A. Okonski
SPE Injection Molding Division Chair
Staff Research Engineer, GM Global Research & Development Center

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APRIL 2023

SPE WEBINAR: DEGRADATION FAILURE OF PLASTICS

TUESDAY, APRIL 18, 2023 11:00 AM (EDT) - 12:00 PM EDT)

WEBINAR VIA ZOOM

Hosted by Jeffrey A. Jansen, Engineering Manager, The Madison Group

Plastic materials offer a unique balance of strength and ductility associated with their inherent viscoelastic nature. However, they are susceptible to molecular degradation through a variety of exposures. Molecular degradation is a permanent change in molecular weight that reduces the mechanical properties and integrity of the plastic material. This degradation can occur during compounding, processing, storage, or while in service.

For more information: https://www.4spe.org/i4a/calendar/details.cfm?id=737&pageID=3277

MAY 2023

2023 AUTO EPCON CONFERENCE

TUESDAY, MAY 2, 2023 8:00 AM (EST) - 5:00 PM (EST)

DETROIT MARRIOTT - TROY, 200 W BIG BEAVER, TROY, MI 48084

Hosted by SPE Detroit Section, SPE Injection Molding Division and SPE Additive Manufacturing TIG

The SPE Detroit, SPE Injection Molding and SPE Additive Manufacturing chapters are pleased to announce the 2023 Automotive Engineering Plastics Conference on May 2, 2023.

There is no more effective event to meet, network and learn with influential engineers and scientist involved in specifying, designing and recommending engineering plastics.

For more information: https://www.4spe.org/i4a/pages/index.cfm?pageid=8018

MAY 2023

SPE WEBINAR: ELEVATING AEROSPACE COMPOSITE MANUFACTURING: THE ROLE OF THERMAL ANALYSIS IN MAXIMIZING EFFICIENCY AND MINIMIZING WASTE

WEDNESDAY, MAY 3, 2023 12:00 PM (EDT) - 1:00 PM (EDT)
WEBINAR VIA ZOOM

Thermosets and composites can be difficult materials to use in serial production. How do you know what combinations of curing temperatures and time can be used? When is it safe to demold parts? And are the final properties what you expect? Without this information, it is impossible to optimize your cycle times and minimize waste. This webinar will introduce how thermal analysis is being utilized by DarkAero to manufacture high-performance two-seat aircraft and composite structures with a new level of technical understanding and engineering confidence.
For more information: https://www.4spe.org/i4a/calendar/details.cfm?id=760&pageID=3277

SPE THERMOSET TOPCON

MONDAY, MAY 8, 2023 12:00 AM (EDT) - WEDNESDAY, MAY 10, 2023 12:00 AM (EDT)
MONONA TERRACE COMMUNITY AND CONVENTION CENTER, MADISON, W
HOSTED BY SPE THERMOSET DIVISION I

Join us for the SPE Thermoset TOPCON 2023 event in Madison, Wisconsin at the beautiful Monona Terrace Community and Convention Center. Join the leaders in the industry and learn about opportunities for thermoset innovative technologies in multiple markets.
For more information: https://spethermosets.org/TopCon/

SPE WEBINAR: BASIC RUBBER TECHNOLOGY

TUESDAY, MAY 16, 2023 11:00 AM (EDT) - 12:00 PM (EDT)
WEBINAR VIA ZOOM

This webinar will introduce the attendees to the basics and most important topics related to thermoset rubber compounds. About 15 billion kilograms of rubber are produced ever year. Rubber finds its way into wide range of applications in the automotive, medical, appliance, electrical, and chemical industries. As a class of materials, rubber has many useful properties because of its unique molecular structure. These include being soft and relatively flexible, high ultimate elongation coupled with good elastic recovery, useful over a wide temperature range, and good chemical resistance.
For more information: https://www.4spe.org/i4a/calendar/details.cfm?id=738&pageID=3277

SPE WEBINAR: REAL-TIME PROCESS OPTIMIZATION WITH IN-MOLD SENSORS AND MACHINE LEARNING

THURSDAY, MAY 25, 2023 12:00 PM (EDT) - 1:00 PM (EDT)
WEBINAR VIA ZOOM

Plastic manufacturing can be unpredictable. Deviations in material batches, moisture content, machine calibration, among other variables, lead to issues in manufacturing quality and final part properties. This webinar will introduce how dielectric analysis (DEA) sensors be used to directly measure material behavior in-mold. New technology has been developed to combine dielectric analysis with machine learning and material models, allowing for dynamic adjustments to machine settings, removing uncertainty from your process, and optimizing cycle times.
For more information: https://www.4spe.org/i4a/calendar/details.cfm?id=761&pageID=3277

AUTO EPCON 2023 CONFERENCE | MAY 2, 2023

Detroit Marriott - Troy Hotel, 200 Big Beaver Rd, Troy, MI 48084

KEYNOTE SPEAKERS

Ankil Shah, *Toyota Motor North America*

Joe Langley, *S&P Global*

Sandy Munroe, *Munroe Associates*

CALL FOR STUDENT POSTERS

POSTER ABSTRACT SUBMISSION DEADLINE: APRIL 10, 2023

ACCEPTED STUDENT PRESENTERS NOTIFIED: APRIL 17, 2023

- Students must bring their posters printed on the template provided.
- For queries regarding the poster session, please email:
  Dr. Brian Knouff: **knouffbj@ornl.gov**
  Dr. Mahmood Haq: **haqmahmo@egr.msu.edu**
- For queries regarding travel assistance, please email:
  David Okonski: **david.a.okonski@gm.com**

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For sponsorship and registration information please use this link
https://www.4spe.org/i4a/pages/index.cfm?pageid=8018

Feature by Marty Mares *VP Branding & Commercial Development*

How the Right Labeling Method can Improve Efficiency and Increase Profits: Polymer Fusion Labeling

For injection molders who manufacture massive amounts of product every day, even the slightest increase in business efficiency could drastically improve profitability, and a disregard of potential improvements could cost even more. That's why it is important that all manufacturers consider every step in the production process, and why a process-oriented technology like Polymer Fusion Labeling is so significant.

About Polymer Fusion Labeling

To understand Polymer Fusion Labeling, you'll need to forget just about everything you know about traditional decorating methods for injection molded polyethylene (PE) and polypropylene (PP). This includes heat transfers, hot stamp foil, stickers, and in-mold labels (IML). All of these labeling methods rely on inks and adhesives to try and "stick" to the surface of a plastic part, which simply doesn't work, due to the natural c haracteristics of plastic, such as:

1. *Non-Polar, Low Surface Energy* – As one of the most "non-stick" plastics in the world today, the "stickiness" of polyethylene (PE) and polypropylene (PP) closely resemble the characteristics of Teflon®, meaning they ultimately reject any attempt at long-term adhesion, and will peel or fade.
2. *High Expansion/Contraction Rate* – These plastics naturally expand and contract within hot/cold environments at a rate 18x more than metals. The adhesion-based labels made of foreign material will expand and contract at a different rate than the container, so much like a band-aid applied over a knuckle, the expansion and contraction of the plastic container will cause the label to fail.
3. *Outgassing* – Plastics like polyethylene (PE) and polypropylene (PP) have microscopic pores which release gas in a process called 'outgassing'. After molding, these plastics naturally outgas over long periods of time, causing labels to bubble and lose adhesion.

Polymer Fusion Labeling approaches these characteristics from an entirely different angle. Where traditional decorating methods introduce foreign inks and adhesives, Polymer Fusion Labels are made of 100% compatible plastics, which are essentially 'welded' to plastic parts using heat. Once applied, the newly integrated label takes on the same durable characteristics of the plastic part, allowing both to expand, contract, and even outgas without any effect on permanency.

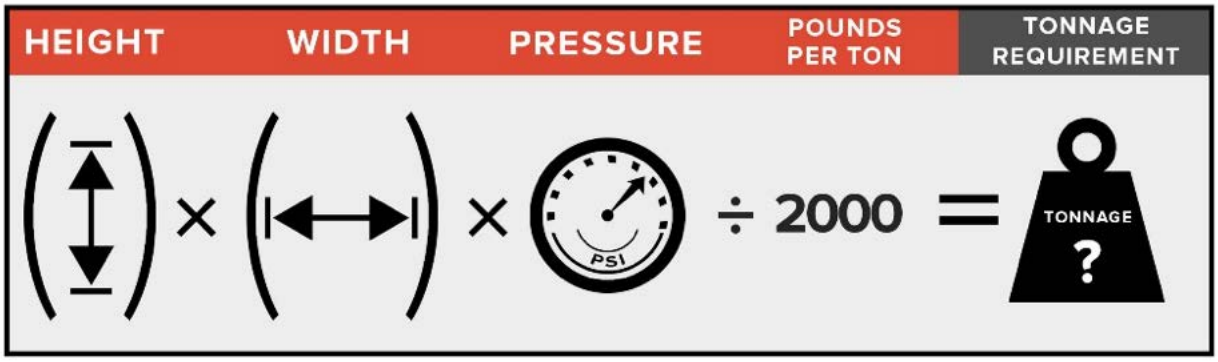
In addition to being the only truly permanent labeling solution for injection molded parts, Polymer Fusion Labeling as a process may also improve business efficiency and profitability.

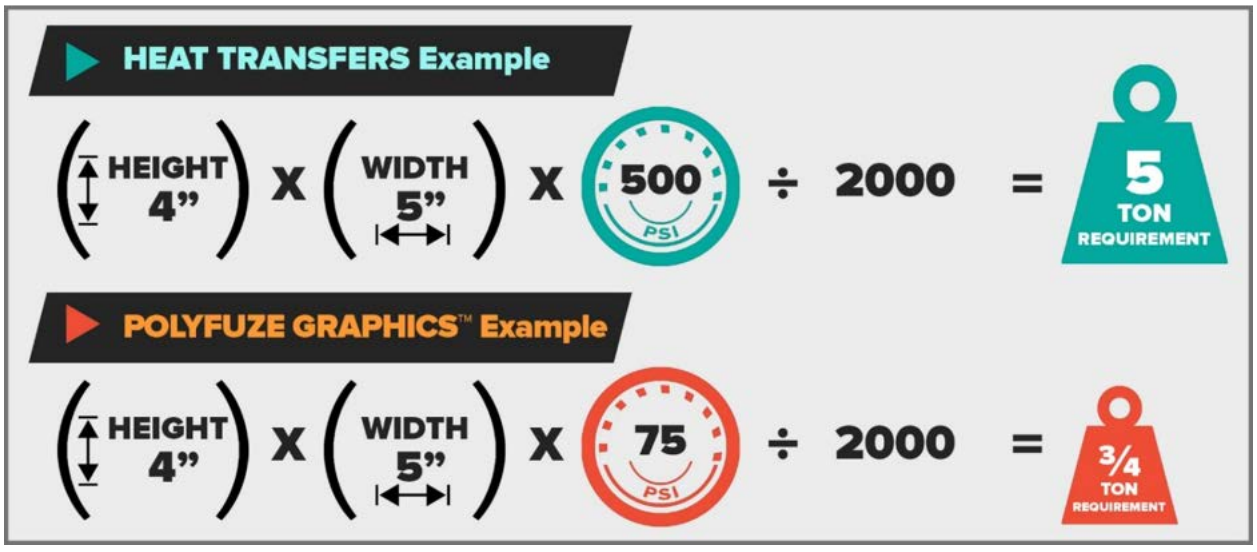
How to Lower Machine Costs with Polymer Fusion Labeling

One advantage of Polymer Fusion Labeling is that it has far lower machine requirements than alternative decorating methods. Where methods like IML's require costly robotics, Polymer Fusion Labeling can easily utilize traditional hot stamp or heat transfer equipment for application, putting even less strain on these machines due to lower tonnage requirements.

Where hot stamps and heat transfers require a pressure of 400-500psi, our process requires only 75psi with a die heated to 550°F, lowering overall machine costs. Additionally, a lower tonnage requirement means that labels as large as 200 square inches can be applied without the use of additional equipment, where alternative methods would require an extra "roll on" machine for graphics larger than about 20 square inches.

The above (vertical press) formula will continue to work for larger size Polymer Fusion Labels. However, since vertical press machines cannot accommodate most Heat Transfer graphics larger than 20 square inches, investment in a more expensive roll-on machine is required.





The above (vertical press) formula will continue to work for larger size Polymer Fusion Labels. However, since vertical press machines cannot accommodate most Heat Transfer graphics larger than 20 square inches, investment in a more expensive roll-on machine is required.

How to Improve Production Speed with Polymer Fusion Labeling

Another advantage of Polymer Fusion Labeling is increased speed in the form of reduced cycle times and faster changeover. Where IML's may add 6 seconds or more to the cycle time of each part, Polymer Fusion Labels can be applied post-mold while other parts are running, eliminating any interruption in the cycle time. That savings of 6 seconds per cycle quickly adds up to hundreds of hours that could be spent running more product and making more money. For example, if you shave 6 seconds off the production of 500,000 parts, you have opened up 833 hours that can be used elsewhere, including running 100,000 parts with 30 second cycle times, which at $10 apiece, is a million-dollar difference. This is a small example of the way Polymer Fusion Labeling can increase both speed and profitability.

How to Reduce Scrap Rates with Polymer Fusion Labeling

In addition to lower machine requirements and higher production speed, Polymer Fusion Labeling can also serve to reduce scrap rates, further increasing efficiency and sustainability. Where uneven wall thickness and sink marks create serious problems for traditional labeling methods, Polymer Fusion Labeling is far more forgiving, and can be easily adjusted to unique surfaces with no effect on print quality, reducing scrap of misprinted parts. An additional benefit comes in the form of recyclability. Once a part reaches the end of its life and is ready to be recycled, traditional labels made of inks and adhesives are considered contaminates and will need to be removed before recycling, but Polymer Fusion Labels are made of 100% compatible and recyclable material.

Polyfuze Graphics Corporation created Polymer Fusion Technology to solve the issues faced by plastic manufacturers related to labeling, including permanency and efficiency. To learn more about how Polymer Fusion Technology can improve your product and your process, call us today at (928) 634-8888 or visit polyfuze.com.

About the Author:

Marty Mares, VP Branding & Commercial Development

Marty leads commercial branding for Polyfuze, while serving as a member of the company's executive team. Throughout the year, Marty serves as an ambassador of Polymer Fusion Technology by attending a variety of domestic / international trade events and customer visits. Marty enjoys being outdoors with his family. He also welcomes visitors to the Polyfuze facility anytime to enjoy beautiful Northern Arizona.

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Feature by Richard Pergler *Pergler Media*

Reduce Energy Consumption and Shorten Cycle Times Using Two-stage Ejectors

The injection moulding experts at CAVITÄT in the German community of Hörden greatly appreciate the benefits of HASCO's two-stage ejectors. The two-step distribution of force of the two-stage ejectors enables the demolding of complex parts at high demolding temperatures – without any warpage or deformation and without any marks left behind by the ejector. The energy consumption for cooling can be reduced and the cycle time can be shortened.

The performance promise given by CAVITÄT GmbH is to ensure fast product development at consistently high quality level within the entire production process, from the initial design of the component, through mold development to final production by injection molding. Orders come in from a wide variety of different industries, predominantly (70 %) from the automotive segment but also from the fields of consumer goods, medical technology, protection technology, the electrical industry, automation and handling technology.

Economical production is of major importance for CAVITÄT. The moldmaking operation, which originated many years ago from a construction bureau, is equipped with state-of-the art automated machinery. Three HSC machining centers are in operation, two of which are integrated into a handling system and, under optimum circumstances, run 24/7. Even the erosion sector is fully automated.

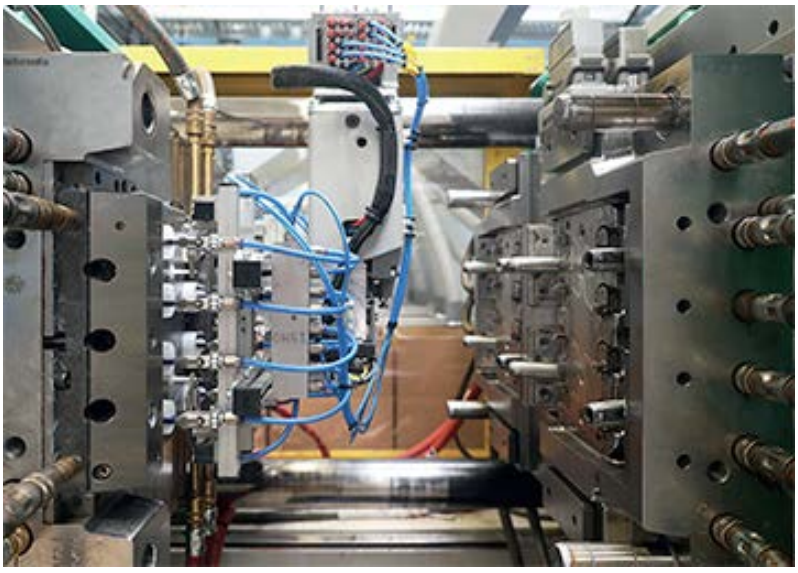


Figure 1: CAVITÄT produces complex plastic components with intricate and challenging structuresin short cycle times. Photo courtesy of CAVITÄT

Figure 2: Jörg Kroß, CEO at CAVITÄT: "We put a great deal of time into the engineering and coordination with our customers in order to be able to offer optimum solutions." Photo courtesy of CAVITÄT

Figure 3:
HASCO offers DLC-coated two-stage ejectors in different designs and sizes.
Photo courtesy of HASCO

"Formerly, our focus in the automotive segment was clearly on visible components," says Jörg Kroß, CEO at CAVITÄT. "However, for some years now we have been manufacturing mainly moulds for technical components in this sector." The chief requirements apart from high dimensional stability, excellent surface properties and other quality criteria are above all short cycle times with good ventilation and low warpage. The molds are designed sustainably for high, reliable quality and optimum economic efficiency in production.

In moldmaking, standards are deployed to ensure both quality and economic efficiency. Alongside our high-quality inhouse production, we also rely on standard parts and components from well-known manufacturers," explains Kroß. "Since our company was founded nearly 20 years ago, HASCO has been our cooperation partner. We purchase virtually all our plate material from them, but also numerous accessory components."

In a current project – a molding tool that was designed for the production of a plastic hose holder for the automotive industry – CAVITÄT used a two-stage ejector from HASCO. This is a thin-walled cylindrical injection molded part with details for fixing in the vehicle.

"With this mold, the challenge was not the free movement of the injection molded component but the specified narrow tolerances for the diameter, which did not allow any demoulding-friendly modifications to the design of the product. The mold had to get by in this area virtually without any draft," says Kroß. "Here, we used a different property of the two-stage ejector: A constant ejector motion was transferred to a controlled two-step distribution of force. This enabled demoulding forces to be reduced and allowed much earlier demolding."

The mold experts at CAVITÄT put a relatively large amount of energy, work and time into the projects at a very early stage during the design of a mould in orde to be able to build an optimum product. Filling analyses and simulations help to save correction loops. The idea is that the articles exit the mould in perfect shape – if possible, immediately after the first trial.

"Our client produces his articles on all-electric machines and he wants to make full use of the speed of the machines," says Kroß. "This means that we must design our mold for a cycle time that is as short as possible so that he can fully exploit the potential of the processes." Apart from a well thought-out cooling concept, this also involves demolding the article while still "hot" with as short a cooling time as possible. Here, too, the challenge is to exploit the process to the limit, without impairing process reliability or process stability. This means that the article is relatively soft when demolded. Conventional ejectors leave undesirable marks behind when ejecting at high temperatures.

The HASCO two-stage ejectors offer the optimum solution for a reliable and controlled process. With a comprehensive range of two-stage ejectors, HASCO offers numerous customised possibilities for reliable movement control and demolding during the injection molding process. The various designs and dimensions can be used as upstream or downstream leading systems. All two-stage ejectors are available ex-stock with

Figure 4: With filling analyses and simulations, numerous correction loops can be saved. Photo courtesy of CAVITÄT

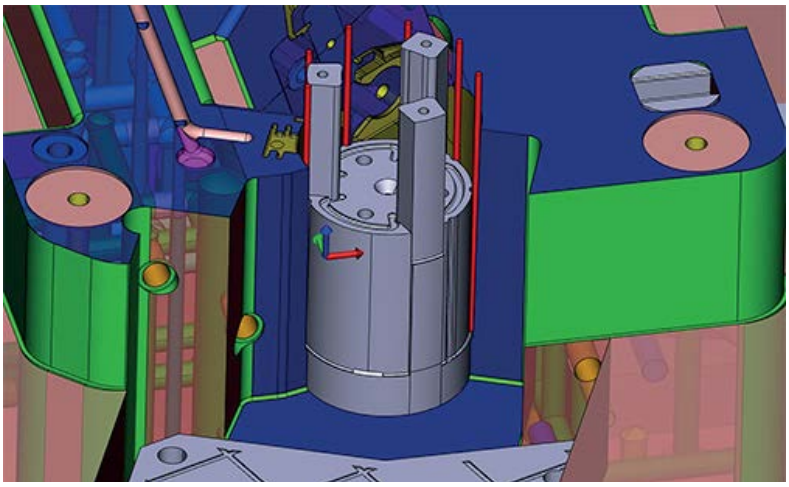


Figure 5: Damage-free ejectionof the articles also at elevated temperatures. Photo courtesy of CAVITÄT

DLCcoated functional surfaces. This enables operation of the injection moulding tools with very little wear and tear. Maintenance intervals can be extended and wear parts can be replaced very much later.

"The possibility of reliably demolding the article while still in a fairly warm state, shortens the cycle significantly," says Kroß, summing up. "We were able to reduce the time taken by 20 % from around 25 sec to 20 sec. This is pure money for our client – he can supply his customers faster and has the injection molding machine free much more quickly for the next order." In addition to this, the solution offers a high level of process reliability.

One very positive aspect for CAVITÄTis that individual parts of the two-stage ejectors can be ordered very rapidly and easily via the HASCO Portal, and reliable delivery ex stock is guaranteed. "This gives our customers additional certainty of being able to continue working quickly and uncomplicatedly in the event of a repair, something which is a very important argument in view of the ever tighter deadlines," says CEO Kroß.

The close partnership between CAVITÄT and HASCO and the shared practical know-how of the experts among one another enable competitive and highly productive solutions – to the benefit of the customers.

As published in The mold & die journal 06/2022"

HASCO

www.hasco.com

Feature by Hank Tsai *Effinno Technologies Co., Ltd.*

Understanding of Plastic P-V-T Relationship on Injection Molding Process

Injection molding is the most popular process in the plastics industry. However, few people know what exactly happens inside molds and their molded parts. Many companies rely on experienced and seasoned molders to set up process conditions for production by trial and error from time to time and batch to batch. And still, often, companies and molders puzzle about the inconsistent quality of their molded parts.

To have an efficient and effective injection molding operation, not just adjusting process parameters on the machine screen by trial-and-error guesswork, molders must have insights into the injection molding process by standing at the plastic material's point of view. Herein, it is essential to understand the physical relationship among the plastic P-V-T (Pressure – Volume – Temperature) across the entire injection molding process cycle.

Generally, plastic material is classified into two categories: amorphous and semi-crystalline. Taking amorphous material as an example, **Figure 1** illustrates the typically dynamic P-V-T (Pressure – Volume – Temperature) relationship across a single injection molding process cycle. Herein, volume refers to the specific volume of plastic material and is defined as the volume per unit mass, meaning the reciprocal of material density. Based on the plastic's point of view, the physical phenomenon of a complete injection molding cycle can be typically presented in **Figure 1**, that a plastic's specific volume increases (expands) with heating (increasing temperature) at a certain pressure, decreases (compressed) with force (increasing pressure) at certain temperature and decreases (shrinks) with cooling (decreasing temperature) at a certain pressure. Further interpretation of the P-V-T chart is as follows.

(1): *Injection starts* - to build the molten plastic pressure at the setting melt temperature.

(1) to (2): *Filling stage* - melt pressure increases at the setting melt temperature while the specific volume decreases as pressure increases.

(2): Filling stage ends; packing stage starts - the part outline is roughly fulfilled molten plastic material at setting melt temperature; cooling starts taking significant effect in reality.

(2) to (3): *Packing stage* - melt pressure keeps increasing while melt temperature starts decreasing; the specific volume continues decreasing as melt pressure keeps increasing.

(3): The melt pressure reaches peak value; process switches into holding stage; the packing stage ends.

(3) to (4): The melt pressure releases when switching from packing to holding stage; the material temperature keeps decreasing; the melt's specific volume increases a bit at first with pressure release then decreases again as holding pressure takes effect.

(4): Holding stage starts.

(4) to (5): *Holding stage* - the melt temperature keeps decreasing because of the ongoing cooling effect in reality; the melt pressure decreases a bit as the melt temperature decreases; the melt specific volume keeps decreasing as the temperature keeps decreasing.

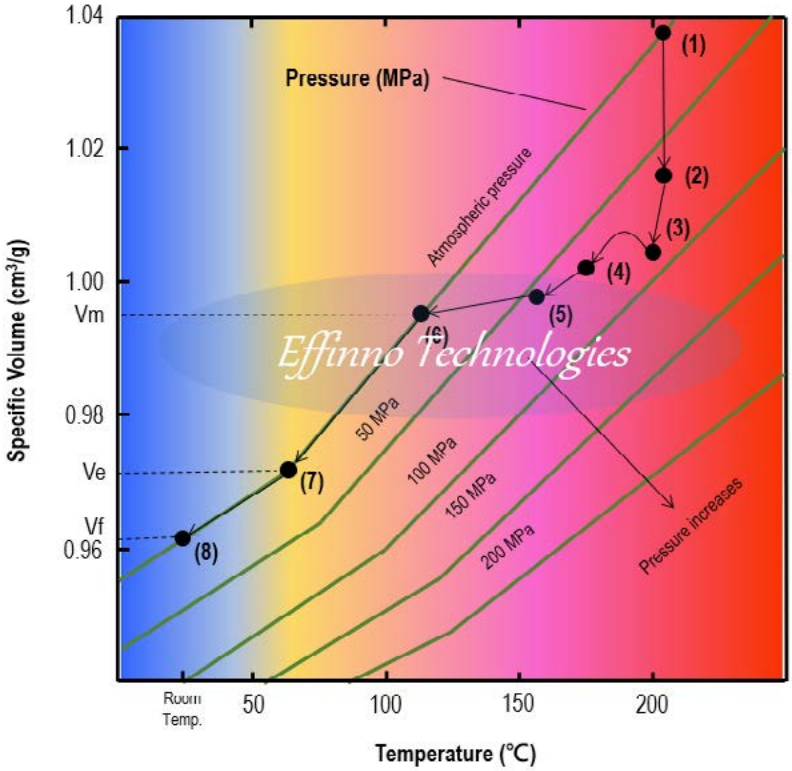


Figure 1: Typical P-V-T (Pressure – Volume – Temperature) diagram of amorphous material

(5): Cavity gate is frozen; the holding stage finishes; cooling stage starts.
(5) to (6): *Cooling stage* - the melt temperature decreases; the melt pressure keeps decreasing; the melt's specific volume keeps decreasing.
(6): *Cooling stage* - the plastic's pressure decreases to atmospheric pressure; dimensions of the molded part are the same as the dimensions of the mold cavity with the plastic's specific volume Vm; the molded part starts shrinking in mold.
(6) to (7): *Cooling stage* - the molded part continues being cooled at atmospheric pressure; the plastic's temperature keeps decreasing at atmospheric pressure; the plastic's specific volume keeps decreasing at atmospheric pressure; the molded part shrinks in the mold cavity.

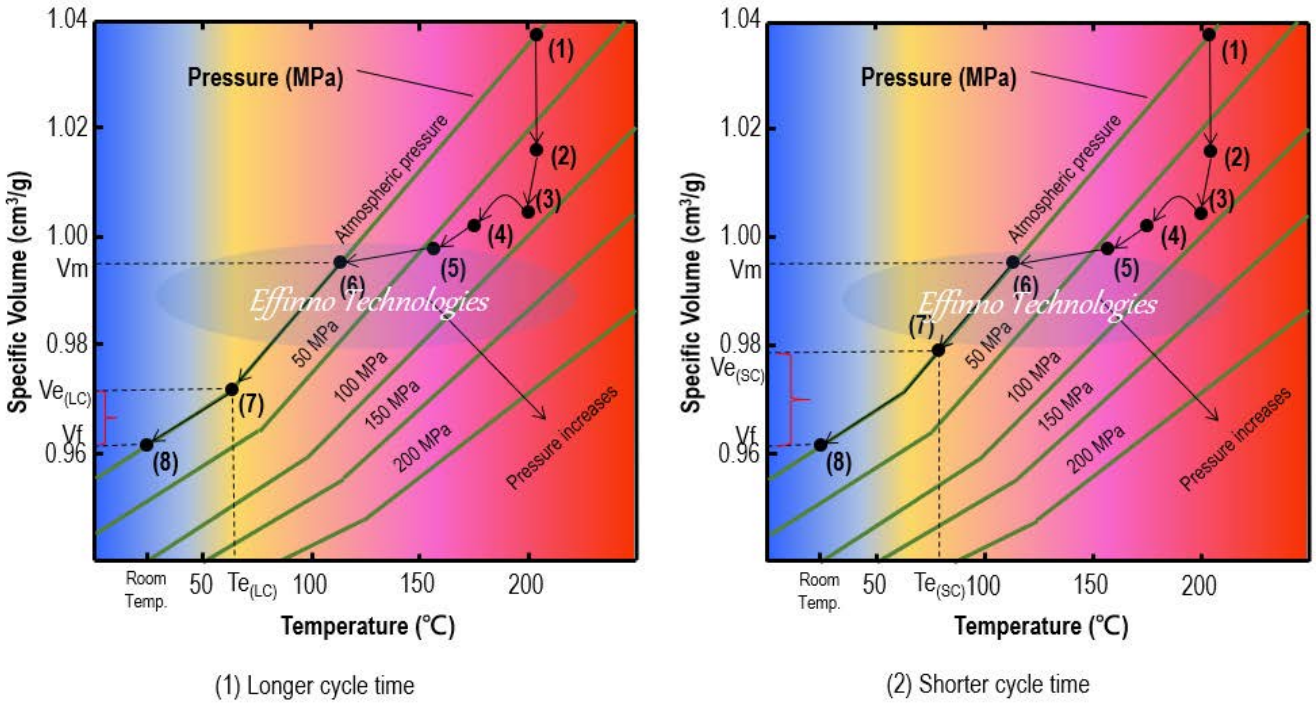


Figure 2: P-V-T (Pressure – Volume – Temperature) diagram - Longer and short cycle times.

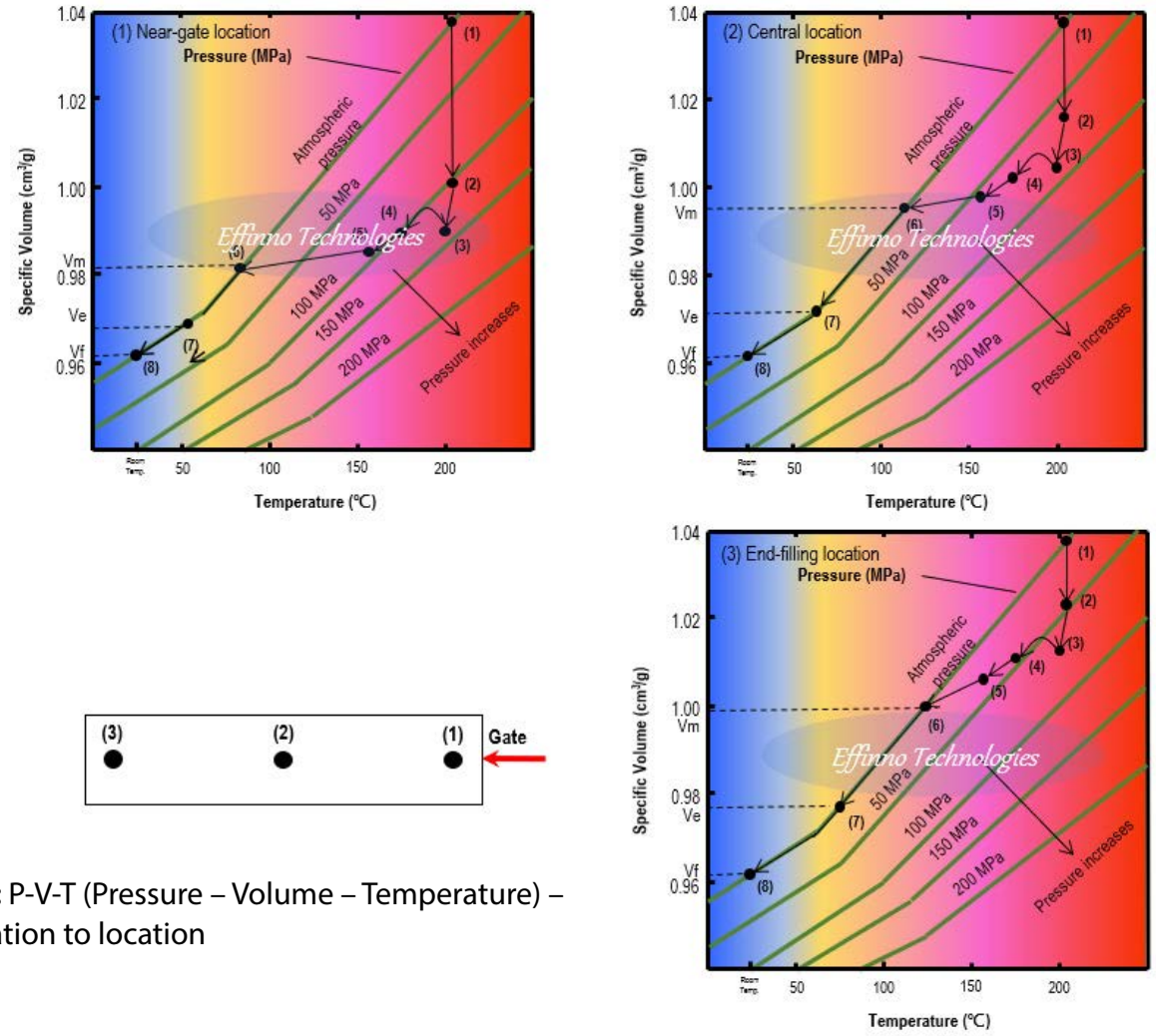


Figure 3: P-V-T (Pressure – Volume – Temperature) – from location to location

(7): The cooling stage finishes; the mold opens and ejects the molded part; the plastic's pressure keeps at atmospheric pressure while the plastic's temperature decreases to ejection temperature, at which the plastic's specific volume decreases to Ve.

(7) to (8): The molded part is ejected and cools in the air at atmospheric pressure; the plastic's temperature keeps

decreasing; the plastic's specific volume keeps decreasing; the molded part continues shrinking in the air.

(8): The molded part reaches balance status at atmospheric pressure and room temperature with the final specific volume Vf of the plastic material.

Based on the fundamental understanding of the plastic material P-V-T chart mentioned above, more insights it brings are worthy of notice.

1. The plastic's specific volume difference between Ve and Vf represents the amount of volume shrinkage that the molded part shrinks freely without any constraint in the air after being ejected from the mold. For example, as **Figure 2** shows, using a shorter cycle time to speed up production means the molded part is ejected at a higher temperature, leaving a more specific volume difference (Ve – Vf) and more amount of free volume shrinkage of the molded part than the longer cycle time. In such a situation, the size or dimension of the molded part becomes smaller and the molded part tends to warp or deform if the inherent volume shrinkage is not uniform.

2. Each path from point (1) to point (8) on the P-V-T chart represents the plastic material's thermal and pressure histories at a certain location of the molded part and mold cavity under an injection molding process condition. The material at different locations of the molded part and mold cavity have different paths to represent their individual thermal and pressure histories at those locations under a single cycle, as **Figure 3** shows. Theoretically, the plastic material of molded part near the gate has in-mold shrinkage (Vm - Ve) and post shrinkage in the air (Ve – Vf) the least, while that at the end-filling location the most for both.

3. Each path from point (1) to point (8) on the P-V-T chart represents not only the plastic material's thermal and pressure histories at a certain location of the molded part and mold cavity under an injection molding process condition but also represents the material's thermal and pressure courses of a single shot (cycle). Individual paths of material at the same locations of the molded part and mold cavity should be kept consistent as much as possible from shot to shot and time to time, which means parts are produced in consistent quality for the long term, as **Figure 4** shows.

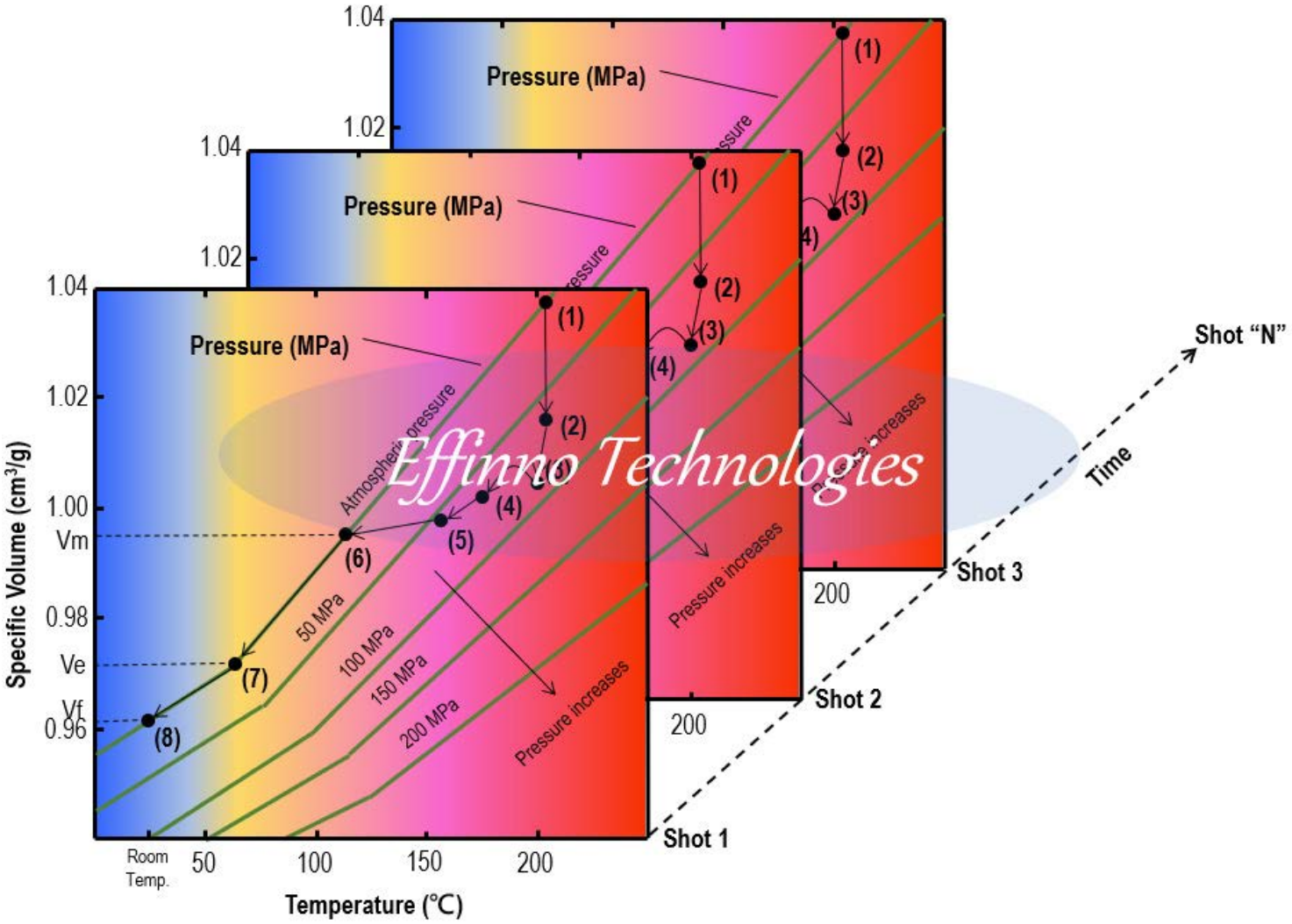


Figure 4: P-V-T (Pressure – Volume – Temperature) diagram – from shot to shot

4. For a multi-cavity mold, plastic material at the same location of the molded part but from different mold cavities have individual paths as well to represent the material's thermal and pressure histories at different cavities. If the process cannot provide balanced filling, packing, holding, and cooling effects on the molded parts from different cavities, the thermal and pressure histories of the material on the molded parts, even at the same locations, will be different from one cavity to another.

5. By employing proper part and mold designs, it can be achieved that more uniform volume shrinkage, i.e. Vm – Ve, from point (6) to (8) of the P-V-T chart, across the entire molded part from a location near the gate to the end-filling extremity.

6. Employ process optimization skills to develop a robust injection molding process condition, which aims to make the P-V-T path pattern at every location of the molded part repeat as much as possible from shot to shot and from time to time.

Fully understanding the plastic P-V-T relationship in the injection molding process does help companies and molders get aware of the inherent complexity of this most popular process, and give more respect to it. Next time, when any parameter of the injection molding process condition on the machine screen is going to be changed, have second thoughts on how it will influence the subsequent molded part quality by thinking about how the change will differ the plastic P-V-T path pattern from that of the previously produced parts. Next time, when setting up a new injection molding condition for new batch production, consider whether the setup will differ in the plastic P-V-T path pattern from the last well-done batch production.

About the Author:

Hank Tsai is the owner and consultant of Effinno Technologies Co., Ltd. (https://en.effinno.com) in Taiwan, an injection molding training and consulting service provider. He has been an SPE member since 1995 and has more than 25-year experience in the injection molding industry. He has expertise in injection molding technologies and practices, production efficiency management, part cost structure analysis, troubleshooting, simulation, mold/process/machine performance evaluation, and process optimization by Taguchi DOE. He is also the co-developer of a cloud-based software system and solution that aims to facilitate the digitalization of the industry's machine utilization and production efficiency management. Contact: hank.tsai@effinno.com.

IMD Board of Directors Meeting January 25th, 2023

Respectfully Submitted by Tom Giovannetti

Welcome & Opening Remarks (David Okonski/ Tom Giovannetti)

Roll Call: 24 active board members on roster: quorum achieved.

Approval of previous Meeting Minutes (Tom Giovannetti)
Motion: Approve previous minutes (David Okonski), and seconded (Jeremy Dworshak). Motion passes

Financial Report (Ray McKee, Treasurer)

Per January 6, 2023, email Ray McKee stated our website/newsletter expenses are about half of our total income from the SPE rebate per year. This continues to be a large expense without any sponsorship/revenue to offset. Also in this financial year, we saw a slight bump in financial position from the Sustainability Rocks conference but that discounts the deposit that we paid pre-pandemic. Overall, the conference lost a modest amount of money. We show a total loss of $2,813.91 and finally, we are compliant with all of our financial reporting to SPE HQ and filed our taxes in November as required. The tax filing is literally a postcard that has us certifying that we do not have revenues in excess of $50K.

Technical Director's Report (Chad Ulven, Technical Director)

Chad Ulven reported that he attended the K Show in Dusseldorf, Germany in October of 2022 and the focus was on sustainability and what that means for different company around the world. Antec will be held in Denver, CO on March 27-30, 2023 with Ray McKee as the IMD Technical Program Chair. The IMD reviewed 43 abstracts and 14-15 papers will be presented in 2 injection molding sessions. Many members of the board expressed concern with only having abstracts to review including the review team. Dave Okonski asked what happens to the papers that don't get accepted to Antec? The BOD discussed using these papers for a TOPCON or other events. The Gottfried Ehrenstein Polymer Colloquium 2023 will be held on March 31 in Madison, WI. Auto Epcon will be held on May 2, 2023 in Troy, MI and will be supported by IMD. David Okonski is one of the conference chairs and currently looking for content. The 2023 Innovation and Emerging Plastics Technologies Conference will be held on June 21-22, 2023 in Erie, PA at The Behrend College and IMD will support. Finally, the National Week of Injection Molding will be July 31 – August 4, 2023. This will be organized by Lynzie Nebel but she will need someone to moderate. Chad talked about ideas for future engagement including: a networking event coupled with a live event, Ask the Expert Series, Mentorship Program, future TOPCON and Webinars.

Action Item: Edwin Tam will draft a letter of concern to the SPE executive board about the selection process for Antec papers. He will submit draft to IMD BOD before sending.

Sustainability Rocks Conference Wrap-Up (Sue Montgomery)

Sue Montgomery reported that the conference lost $2,813.91 but was a great success. We had 63 attendees of which 18% were speakers, 16% were sponsors and 33% were students. The speakers and sponsors were very pleased with the conference and the students were very engaged by asking lots of questions. Overall, the venue, content and food was enjoyed by all. Sue stated that we should form a sponsorship committee for the next conference and start working at least one year ahead. Susan also reported that the Akron Section put on a sustainability webinar and wondered if the IMD should co-promote events with other Sections.

Action Item: Send Susan Montgomery contact information for Program Chairs of other local sections that our BOD's are members of.

Councilor Report (Edwin Tam)

No Report. No councilor meeting since last report.

Communications (Newsletter) Committee Update (Angela Rodenburgh)

Angela Rodenburgh reported the IMD Newsletter has a 23-25% open rate and about 35 people click through the document. She also stated that we need at least a few months in advance for events to be put on web site. Finally the IMD web site needs a refresh and Angela will look into cost. Edwin Tam suggested sharing IMD Newsletter with other groups emails lists.

Action Item: Angela Rodenburgh will look into cost of upgrading IMD web site.

Membership Committee Update (Erik Foltz)

Erik Foltz reported we have 1002 members of the IMD where 739 are professional members, 86 Young Professional, 86 Student, 84 Emeritus and 7 Distinguished.

Nominations Committee Update (Hoa Pham)

Hoa Pham reported:

IMD BOARD OFFICERS
2023 NOMINATION

BoD Officer Position	Ends on June 30, 2023	Nominee For 2023- 2024
Chair	David Okonski	Jeremy Dworshak
Chair Elect	Jeremy Dworshak	David Kusuma
Treasurer	Raymond McKee	Raymond McKee
Technical Director	Chad Ulven	Chad Ulven
Secretary	Tom Giovannetti	Davide Masato

CANDIDATES FOR BOARD DIRECTORS

2023 NOMINATION

Term 2023 – 2026; ends on June 30, 2026

Nominees for IMD General Ballot	Nominees To Be Exempted after Board Officer Approval
Brad Johnson	Raymond McKee
Susan Montgomery	
Joseph Lawrence	
Lynzie Nebel	
Sriraj Patel	
Saeed Farahani	
Thomas Giovannetti	
Hoa Pham	

Nominee for Councilor 2023 - 2026	Edwin Tam

Motion: Approve nominated candidates (Hoa Pham), and seconded (Edwin Tam). Motion passes

Motion: Approve nominated candidates (Hoa Pham), and seconded (Tom Turng). Motion passes
Hoa Pham asked candidates for bio's.

ANTEC TECHNICAL PROGRAM CHAIR

Name	Term	TPC Of:
Raymond McKee	2022 - 2023	ANTEC 2023
Tom Giovannetti	2023 - 2024	ANTEC 2024
Davide Masato	2024 - 2025	ANTEC 2025
Saeed Farahani	2025 – 2026	ANTEC 2026

Overview of Chair Progression

On 10/14/2022, the Board approves including Secretary in the progression.

Term	Secretary	TPC	Chair-Elect	Chair
2022 - 2023	Tom Giovannetti	Raymond McKee	Jeremy Dworshak	David Okonski
2023 – 2024	David Masato	Tom Giovannetti	David Kusuma	Jeremy Dworshak
2024 – 2025	Saeed Farahani	Davide Masato	Tom Giovannetti	David Kusuma
2025 - 2026	?	Saeed Farahani	Davide Masato	Tom Giovannetti
2026 - 2027	?	?	Saeed Farahani	Davide Masato
2027 - 2028	?	?	?	Saeed Farahani

❑ Need Line Up for Secretary 2025 and beyond to cascade to TPC, Chair Elect and Chair => **Call for volunteers**

Sponsorship Committee Update (Sriraj Patel)

No Report.

Fellows & Honored Service Member Update (Tom Turng)

Tom Turng reported Brad Johnson was elected as a Honored Service Member. Tom asked for nominations.

Awards & Scholarships Committee Update (Lynzie Nebel)

Lynzie Nebel reported that the scholarship application process is open now. She also reported that we have not given the Outstanding Young Injection Molding Professional Award since 2019. Chad Ulven asked how we can give the best paper award at Antec with no papers. Chad will look into awarding the best presentation award.

Education Committee Update (Srikanth Pilla)

No Report.

New Business/Next Meeting Venue and Dates

David Kusuma told the board that Husky Technologies is willing to host the IND for a BOD meeting.

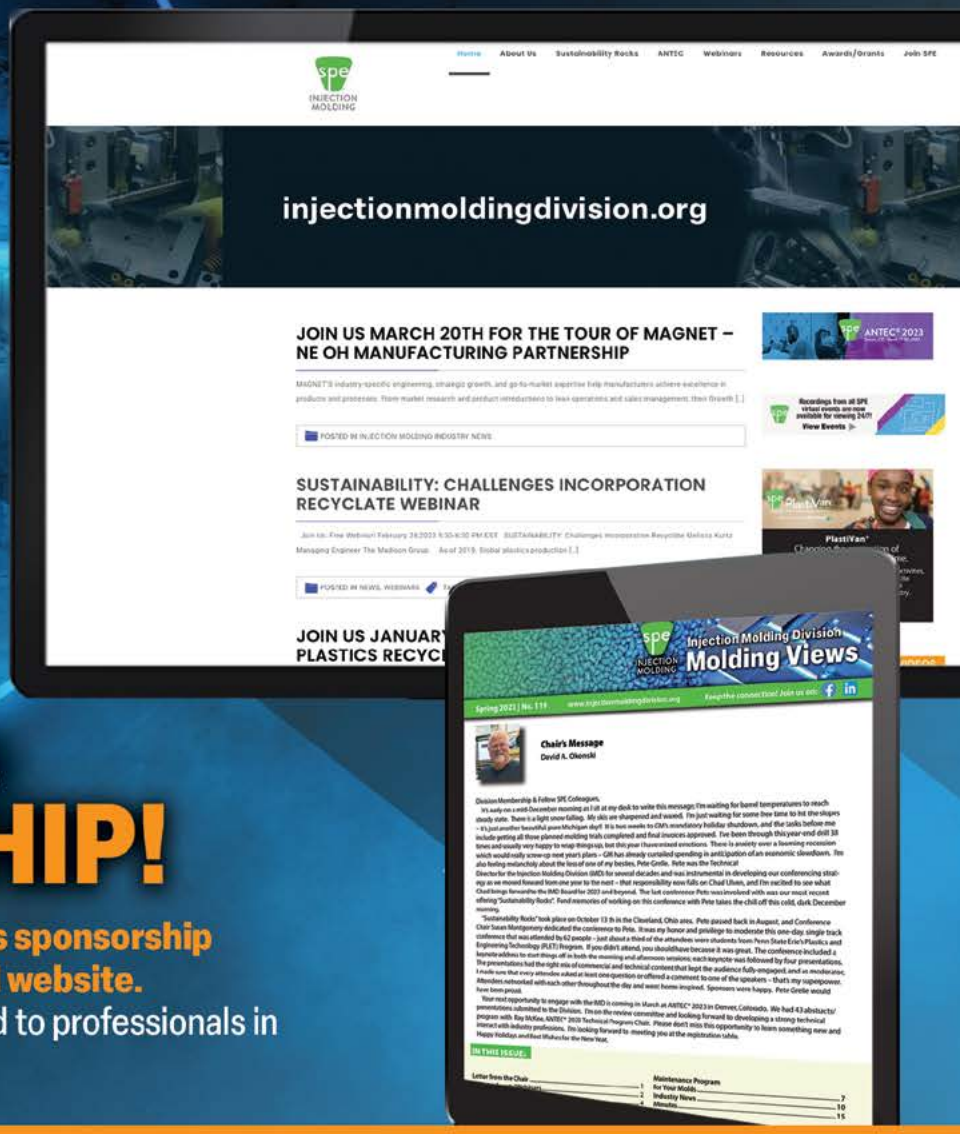
Action Item: David Kusuma and Dave Okonski will discuss with Husky the details of a meeting including location and time.

Adam Kramschuster has resigned from the IMD BOD effective January 25, 2023.

Next BOD meeting will be after ANTEC.

Adjournment

Motion to adjourn (Dave Okonski), and seconded (Tom Turng).
Motion passes.



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INJECTION MOLDING

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The Injection Molding Division offers sponsorship advertising with the newsletter and website.
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The SPE Injection Molding Division Newsletter readership is composed of individuals involved in all aspects of the injection molding industry. These issues are made possible through the support of sponsors shown in this Newsletter and injection molding website.

SPONSORSHIP OPPORTUNITIES:

OPTION A: $1,500/yr
- Full page ad in 3 newsletters (8.5"w x 11"h)
- Banner ad on website for year (300 w x 200h pixels)
- Product news realease on website and social media

OPTION B: $750/yr
- Half page ad in 3 newsletters (7.5"w x 4.75"h)
- Banner ad on website for 6 months (300 w x 200h pixels)
- Product news realease on website and social media

OPTION C: $300/yr
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- Banner ad on website for 1 month (300 w x 200h pixels)
- Product news realease on website and social media

To schedule your ad contact: publisherIMDNewsletter@gmail.com

Injection Molding Division Board of Directors

Division Officers:

Chair: David Okonski (General Motors)
Chair-Elect: Chad Ulven (C2Renew)
Treasurer: Raymond McKee (Currier Plastics)
Secretary: Susan Montgomery (Boardman Molding)
Technical Director: Peter Grelle (Independent Consultant)
Education Committee Chair: Srikanth Pilla (Clemson University)
Past Chair: Joseph Lawrence (University of Toledo)

Board of Directors:

Communications Chair: Angela Rodenburgh (Ladder Up)
Communications Committee: Adam Kramschuster (University of Wisconsin)
Membership Chair: Erik Foltz (The Madison Group)
Sponsorship Committee Chair: Sriraj Patel (Currier Plastics)
Sponsorship Committee: Alex Beaumont (Beaumont Technologies), David Kusuma (Tupperware)
Education Committee: Vikram Bhargava (Independent Consultant),
Dr. Saeed Farahani (Clemson University), Chad Ulven (C2Renew)
Awards/Scholarships Chair: Lynzie Nebel (Tech Tank)
Awards Committee: Kishor Mehta (Retired Plastics Engineer), Tom Turng (University of Wisconsin)
Board Nominations Chair/Historian/Asst. Treasurer: Hoa Pham (Freudenberg Performance Materials LP)
Board Nominations Committee: Brad Johnson (Penn State)
Bylaws Chair: David Okonski (General Motors)
Bylaws Committee: Hoa Pham (Freudenberg Performance Materials LP), Peter Grelle (Independent Consultant),
Jeremy Dworshak (3M), Kishor Mehta (Retired)
Technical Programs Committee: Susan Montgomery (Boardman Molding)
Councilor: Edwin Tam (Teknor Apex)
Board Members: Larry Geist (Ferguson Production), Amanda Nicholson (Moldex 3D), Davide Masato

ANTEC TCP :

2023 Raymond McKee
2024 Tom Giovannetti
2025 David Masato
026 Amanda Nicholson

EMERITUS:

Jack Dispenza
Larry Cosma
Mal Murthy
Jim Peret
Larry Schmidt
Nick Fountas
Kathy Schacht
Jon Ratzlaff
Heidi Jensen