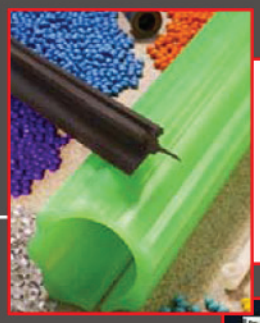
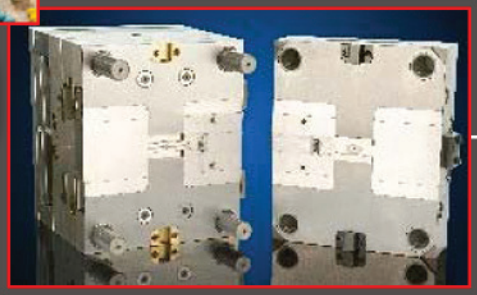
Fall 2015 | No. 100





MOLDING VIEWS

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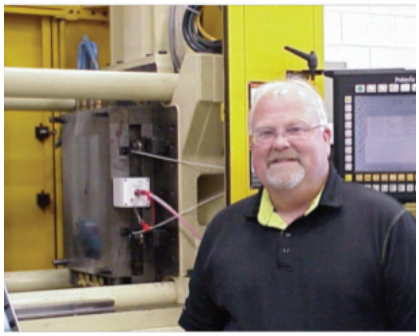
Chair's Message



IMD Membership & Fellow SPE Colleagues,

I hope everyone had a wonderful summer and that you are now enjoying fall; it has been beautiful here in Michigan this autumn, and it just so happens that fall is my favorite time of the year. Favorite not only because of all the brilliant colors displayed by the sugar laden maples but also due to the vast and varied programing offered by the various SPE Sections and Divisions. For instance, the IMD Board of Directors just had our fall meeting at the 2015 TPO Automotive Engineered Polyolefins Conference located in Troy Michigan. The "TPO Conference" is an annual event offered by the Detroit Section. What a great conference at which to convene the IMD Board; there were over 70 technical papers to see, over 70 exhibitors to visit, and three great networking receptions that allowed attendees to rekindle old relationships and establish some new. The IMD Board used this conference as the backdrop for a series of strategy sessions over the three days that allowed us to hear some constructive criticism from fellow SPE colleagues and to think about the future of the IMD — to think about the kind of value-add, must-have

In This Issue:

This Month's Features:

Chair's Message Continued

technical programming we could offer our membership in the years to come. I'm very excited about some potential partnerships that where discussed with the Detroit Section, in particular, that would target custom molders across the transportation sector from planes, to trains, and to automobiles (you get the idea – BIG). Look for more detail in future IMD newsletters and on our website http://injectionmolding.org/.

Finally, I would like to take this opportunity to plead with my colleagues from industry to get more involved with the IMD. Now is the time to think about and then write about something you have accomplished over the last several years for ANTEC 2016. Conference feedback indicates that attendees desire to hear more about industry success stories – papers/presentations about concept development and part design, papers/presentations about tooling strategies, papers/presentations about bio-polymers and sustainability, papers/presentations about ……. If you are not up to this challenge, you could consider becoming an IMD Sponsor. Sponsorship monies help your Board fund: 1) the ANTEC IMD Reception, 2) community outreach programs, 3) technical programming such as TOPCONs, Minitecs, and webinars, and 4) senior capstone projects at universities such as Penn State Erie – The Behrend College and Western Michigan University. Please contact me directly to discuss any one of several levels of sponsorship that are available as well as other opportunities where you can make a difference; you can find my email address on the IMD website.

Best regards to all,
David A. Okonski
IMD Chair & Staff Engineer, GM Global R&D Center

Industry Events Calendar

Click the show links for more information on these events!

November 2015

November 11
SPE Automotive Innovation Awards Competition & Gala
Burton Manor, Livonia (Detroit), Michigan
https://www.eiseverywhere.com//ehome/125723

November 12
Failure Analysis Webinar
http://www.4spe.org/Events/event.aspx?EventID=61305

November 18
Injection Molding Series
http://www.4spe.org/Events/event.aspx?EventID=61306

February 2016

February 9-10 2016
MD&M West 2016
Anaheim, CA
mdmwest.mddionline.com

February 21 - 24 2016
2016 SPE International Polyolefins Conference
Hilton Houston North
Houston, Texas
https://www.eiseverywhere.com//ehome/120999

March 2016

March 10-11
10th European "Thermoforming" Conference 2016
Sitges (Barcelona), Spain
http://www.4spe.org/Events/Event.aspx?EventID=60391

March 29-31
Film/Profile/Sheet Extrusion
Gurnee, IL
http://www.4spe.org/Events/event.aspx?EventID=61848

April 2016

April 16-20
Themoset 2016
Cleveland, OH
http://www.4spe.org/Events/event.aspx?EventID=59039

May 2016

May 23-25
ANTEC 2016
Indianapolis, IN
https://www.eiseverywhere.com//ehome/127608

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SUBMISSION TOPICS

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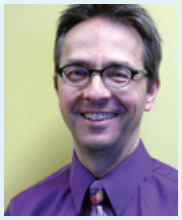
- Engineering Properties and Structure
- Extrusion
- Failure Analysis and Prevention
- Flexible Packaging
- Injection Molding
- Joining of Plastics and Composites
- Medical Plastics
- Mold Technologies
- Plastic Pipe and Fittings
- Plastics Educators
- Plastics Environmental
- Plastics in Building and Construction
- Polymer Analysis
- Polymer Modifiers and Additives
- Product Design and Development
- Reaction Injection Molders
- Rotational Molding
- Thermoforming
- Thermoplastic Elastomers
- Thermoplastic Materials and Foams
- Thermoset
- Vinyl Plastics

Join our Fall webinar series only at SPE.

Failure Analysis Webinar

November 12: Presented by Jeff Jansen, The Madison Group



Jeffrey A. Jansen is Senior Managing Engineer and a Partner at The Madison Group, an independent plastics engineering and consulting firm.Jeff specializes in failure analysis, material identification and selection, and aging studies for thermoplastic materials, and has been solving polymer-related problems for 23 years. In that time, he has performed over 1050 failure investigations, both for industrial clients and as a part of litigation. Jeff served for two years as the ANTEC Technical Program Chair for the Failure Analysis and Prevention Special Interest Group. He followed that as Chairperson of FAP-SIG for an additional two years. He has authored numerous articles and an ASM handbook chapter relating to failure analysis.

Jeff is a regular presenter on the SPE webinar series, covering a wide range of topics related to plastics failure, material performance, testing, and polymer technology. Jeff is a graduate of Carroll College and the Milwaukee School of Engineering.

Injection Molding Design Fundamentals

November 18: Presented by Mark Matsco, Bayer Material Science

In order to meet the demanding challenges of performance, appearance, and cost economics of a plastic part application, the part design must accommodate the unique properties of plastic materials and take full advantage of the design possibilities afforded by the molding process. The design must be tailored to meet the structural and dimensional needs of the application, and where possible, should incorporate integration features that ease assembly and handling. At the same time, the part design must also work within the constraints the injection molding process, to meet quality and cost targets.

This webinar is intended for anyone involved in the design and manufacture of molded thermoplastic parts. The focus will be on the fundamentals of injection molded thermoplastic part design, providing specific recommendations for materials such as polycarbonate and polycarbonate blends. Key topics include the design process, structural design, design for assembly, surface quality considerations and design for moldability. Several advanced topics such as design for thin-wall, gas-assist and other advanced processes will also be discussed.

In 1982 Mark M. Matsco began his career as a Structural Engineer for Bechtel Power Corporation. He became a Research Assistant at Michigan Technological University in 1984, and in 1985 he accepted a position as Research Engineer with Dow Chemical. He joined Bayer Corporation in 1987 as a Senior Design Engineer. In 1989, he started a delegate assignment to Bayer AG in Leverkusen, Germany where he worked in processing, CAE, design, testing and marketing. He returned to Pittsburgh in 1993 as Design Engineering Supervisor. Two years later he was promoted to Manager of Innovative Technologies, a position he held until his Technology Manager appointment with Exatec LLC, a joint venture company formed by Bayer AG and GE Plastics. In 2001 Matsco returned to Bayer Corporation in Pittsburgh in the position of Processing Technology Manager. In 2002 Matsco was appointed Director of Application Development. In this role he leads the Application Development team in providing plastic part/mold design, engineering, cost estimations, computer-aided analysis, tooling expertise, optimization, concept solutions, advanced processing, part testing and on-site technical service.

Matsco received both his bachelor's degree in structural engineering and master's degree in mechanical engineering from Michigan Technological University. A member of the Society of Plastics Engineers (SPE), Society of Automotive Engineers (SAE) and author of numerous technical papers, Matsco is a frequent speaker at plastics industry events. Matsco currently holds seven design and process patents.

Webinars

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Reduce the Cost of Making Plastic Parts through CAE Simulation Solutions

December 02, 2015
10:30 AM CEST/ 3:00 PM IST

The injection molding process involves hundreds of variables. The conventional trial and error approach is a time and cost consuming approach to optimize the process. In this webinar, you will learn how Moldex3D plastic injection molding simulation software can effectively help reduce costs and time to market. Industrial cases will be presented to showcase the advantages of using CAE simulation solutions.

Up to 50% more Working Life for Counter-Rotating Twin Feedscrews

December 03 ,2015
2:00 PM

CarbideX is a family of protective surface treatments by Extreme Coatings that provides the ultimate resistance to corrosive attack in high chloride containing process environments (PVC / CPVC, etc.) Traditional hard chrome plating (HCP) has been the standard surface protection for twin feedscrews. However porosity, non-uniform deposit and final layer thickness of HCP, all conspire to reduce the useful working life of chrome plated feedscrews. CarbideX by Extreme Coatings will outlast HCP by a factor of at least 2 to 1. Finally a product that moves the needle on machine uptime which translates into more consistent high-quality production at the die head.

Fundamentals of Twin-Screw Extrusion Polymer Melting: Common Pitfalls and How toAvoid Them

The process for compounding engineered polymer formulations is comprised of several unit operations. These typically include, but are not limited to: feedstock introduction, polymer melt-mixing, distributive/dispersive mixing of minerals/fibers, removal of volatiles, and pressurization for discharge. While each of these unit operations has an impact on the resulting process productivity and quality of the finished product, polymer melt-mixing has a significantly greater impact than the others. First, it consumes 50, 60 or even greater percent of the total system energy. Second, it generates the highest radial as well as particle-particle interactive pressure and stress of any unit operation. Third, the negative impact on the process of any design flaws in the melt-mixing configuration is transmitted downstream to all the subsequent unit operations. For example, a melt-mixing design that is too intense may degrade the polymer while one that is too weak may result in excessive breakage of glass fiber being fed downstream due to the polymer solidifying on the glass and subsequently being remelted. Another example of the impact of an incorrect melt-mixing configuration would be excessive abrasive wear and possible adhesive wear and deformation on both barrel wall and screw elements due high radial pressure. Additionally, non-melting material present during the melt-mixing process could be compacted into "briquettes" by the high radial pressure that would have to be dispersed by subsequent downstream unit operations. This presentation provides a further discussion of the issues noted above as well as associated examples.

3D Printed Rapid Tools for Injection Molding

Learn how 3D printed molds can cut turnaround time for your injection molded (IM) prototypes. We will discuss when 3D printed molds are a best fit, material selection and customer stories, as well as process limitations and tips for successful molding.

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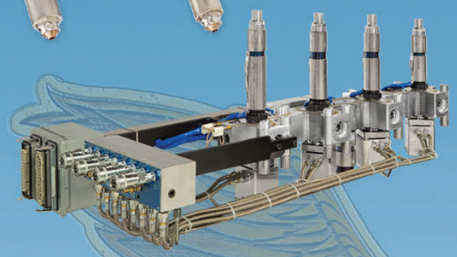

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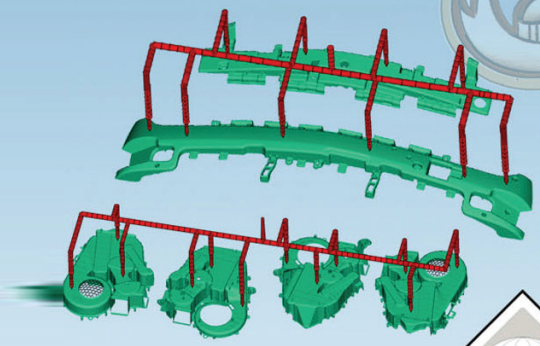

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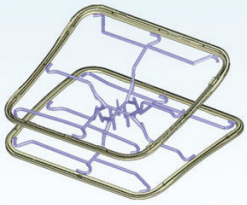

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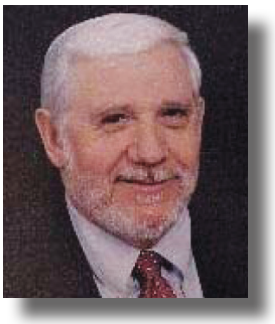
Ask the Experts: Bob Dealey

The Helix Angle and Material Costs



Q: **"I'm working on a project with threads and the term Helix Angle is used. What is the Helix Angle and how is it determined?"** *— Stan a MoldDesigner*

A: I did a little research on this one and found the following in The Society of Plastics Industry — Plastic Bottle Institute that defined Helix Angle and provided a formula.

Quoting from that literature: "Helix Angle is the measure of inclination of the thread, from a plane perpendicular to the vertical centerline of the thread finish."

Then SPI listed the following formula:

$$\tan = \frac{Pitch}{\pi\left(\frac{T+E}{2}\right)}$$

Where:
tan = tan, helix angle
T = Mean thread "T" diameter
E = Mean thread "E" diameter
Pitch = decimal dimension based on number of threads per inch

Bob Dealey, owner and president of Dealey's Mold Engineering, Inc. answers your questions about injection molding.

Bob has over 30 years of experience in plastics injection-molding design, tooling, and processing.

You can reach Bob by e-mailing molddoctor@dealeyme.com

Q: **"We recently realized that we had not adjusted material costs on an active part that went into production in 2001, where the material cost was based on prevailing industry average cost of Homopolymer Polypropylene (PP). The original supplier is not a resource as they are no longer in business. How can I determine what the price for PP was in 2001?"** *— Jacob a Sales Manager*

A: A good source would be Plastics News pricing chart. I located a September 3, 2001 issue and they list PP Homopolymer, injection, general purpose grade at .30 -.32 cents per pound in annual volumes greater than 20 million pounds and .33 - .36 cents per pound in annual volumes of 2 to 5 million pounds.

By Dallas Cada
dallascada@charter.net

Screws and Barrels for Long Fiber Reinforced Thermoplastics

Selecting the right type of screw and barrel for processing any material is a very important step. One not only needs to think about cost but what and how long do you expect any given screw and barrel to last. The old adage of course is "you get what you pay for". This tech brief will cover many resistant materials you can choose from for your particular operation. The main focus of this tech brief will cover the preferred type screw for LFRTP (long fiber reinforced thermoplastics). Keep in mind that the information you are about to read is done in a perfect LFRTP world. You may use it or set your own course as needed for your particular application and its process.

A general purpose metering type screw is preferred for optimum processing of LFRTP. The screw consists of a feed, transition and metering sections. The feed section has a constant root diameter. The screw slopes up in an involuted taper to the metering section, which has a larger constant root diameter than the feed section. Typical design specifications for a preferred metering screw design for LFRTP should meet the following guidelines:

- Zone distribution = 40% feed, 40% transition, and 20% metering.
- Low compression ratio = 2:1 to 3:1
- LD ratio = 18: I to 22: I
- Preferred screw diameter = 40 mm
- Preferred feed zone channel depth = 7.5 mm
- Preferred metering zone channel depth = 3.5 mm
- Pitch = ID

Take note of the preferred deep channel depths. This is especially important when concerned about wear and LFRTP. A screw is an auger system that will deliver material through the barrel as easily as possible. Inadequate depth within the screw flights and its root will cause an increase in shear forces involved with material delivery. And as we know, more shear equals more wear on the screw and barrel. Therefore the deep flights enable an easy delivery of the long pellets throughout the barrel.

In general, an improper screw design or a poor choice of materials for the screw and barrel will result in premature wear. This usually means the barrel/screw gap increases. A typical gap between a barrel and screw can be anywhere between 0.002" to 0.004" depending on machine size. Once both barrel and screw start to wear, the gap will generally increase an additional 0.002" - 0.004". The resulting symptoms include increased melt temperature, back flow, and material and part degradation. To compensate one must think about the "right" screw and barrel materials you should use for general polymers and more important processing LFRTP. The following tables provide a comparison of screw and barrel liner component materials.

Screws & Barrels for Long Fiber Reinforced Thermoplastics Continued

Resistant Materials for Agitator/Screw Components

Base Material	Wear-Resistance Treatment	Wear Material	Resistance	
			Wear	Corrosion
Carbon Steel	Nitrided	4140	X	X
Alloy Tool Steel	Throu2h Hardened	440C	XX	XX
Carbon Steel	Sprayed and Fused	Tungsten Carbide	XXX	XX
Carbon Steel	Welded	Stellite	XX	X
Nickel Alloy	Precipitate Hardened	Stainless Steel	XX	XXXX
Vanadium Alloy	HTP	CPM9V	XXXX	X

Resistant Materials for Barrel Liner Components

Base Material	Wear-Resistance Treatment	Wear Material	Resistance	
			Wear	Corrosion
Carbon Steel	Nitrided	4140	X	X
Alloy Tool Steel	Through Hardened	44OC**	XX	XX
Carbon Steel	Sprayed and Fused	Tungsten Carbide	XXX	XX
Nickel Super Alloy	HIP	Bi-Metallic***	XXX	XXX
Vanadium Alloy	HIP	CPM IOV	XXXX	X
Duplex Stainless Steel	Sprayed and Fused	Tungsten Carbide	XXX	XXXX

**Standard **Standard up to 80 mm ***Standard from 100-160 mm X Fair XX = Good XXX = Very Good XXXX - Excellent*

The above table gives you options to select the best resistant materials for the type resin or material you are processing. It appears the best screw for LFRTP would be made out of a carbon steel material that is sprayed and fused. Tungsten carbide would provide the best wear material. Bi-metallic barrel liners should have a nickel super alloy material with a HIP wear-resistant treatment. There are also many other options on the market such as, Wearstar@ resistance package from Cincinnati Milacron , which provides a 3-year wear resistance guarantee or the Ultramax barrels from Inductametals, (Chicago), which has run 55% glass products for as long as 2 years before showing signs of wear.

In conclusion, you can see that there is a lot more than meets the eye, when selecting the right screw and barrel. With all of today's information, one should expect screws and barrels to last longer. Selecting the right ingredients is the key.

About the Author

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

Feature: Benefits of Rheology Simulation

By Silvestre Cano
Schneider Electric
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silvestre.cano@schneider-electric.com

Benefits in Using Rheology Simulation in Early Stages of the Design Process

The usage of different digital prototyping tools has supported the designers and engineers in building virtual models for visualizing, exploring and analyzing a product in its early design stage. The first concepts are studied in different environments and decisions come even before running the first steps of product development. These models can even be shared with groups far away in order to have second opinions or just for collaborative work.

For more than 20 years, Rheology simulation has proved to be a good base for making decisions on manufacturing processes and tooling before getting into production. Using plastic injection simulation results for filling, packing, and cooling of a molded plastic part help in having a good image of the behavior of the part. The analysis outcome servers as a basis for making decisions and then the needed tooling is ordered. At this stage changes are less expensive. Sometimes solving and preventing production problems is also a good way of getting advantage of results from simulation.

During the last decade, some of the new products have been developed using Rheology simulation from the beginning of the design process. This approach has been a base to predict and improve how the product will behave during each phase of the design and manufacturing process, respectively. The aim of this change is to bring this type of simulation much earlier, so that savings, defects and optimization opportunities can be identified.

Changes are much cheaper to make digitally when working on a computer than on a tooling that is already been manufactured. Implementing Rheology simulation

Feature: Benefits of Rheology Simulation Continued

earlier in development stages supports engineering departments in solving potential problems prior to product release. Zones that need to be reinforced and be identified as well as areas with an excess of material. Reducing the weight of the parts by changing the geometry is reflected in saving in the bottom line. Balancing the size of runner systems and gates also contribute to reduce waste of material and increase savings. The final result is shown as a lower manufacturing cost of the products.

When working with complex parts, it is not easy to visualize the defects that may be presented in the production parts. Simulation is a good way to identify the potential problems like short shots, weld lines, air traps, voids, etc. Working together with industrial design teams is a good way for improving the appearance of the parts and reducing the impact that marks have in the final products. Some weld lines are not possible to avoid, but if they are clearly identified in early stages, it is possible to find a solution so that they do not have a big impact. Different gate locations can be simulated to improve these situations.

Testing different materials before the process is completely defined provides a benefit. Sometimes according to the needed properties, there are two or three materials that are suitable for the product. Understanding the way each one behaves, will lead to decide the better option. Optimizing the design and the material may result in potential saving. The aesthetic perception with the customer and the quality are secondary aspects that contribute to the benefits of simulation results.

One of the most interesting benefits that early simulation has given to our company relates to the variance in the parts. Tolerances can have a high impact in the assembly and in the product´s performance. When talking about electric industry, this can be a really serious topic. Cooling and packing of the parts can highly contribute to variations related to parts´ tolerances. With an approximation of the shrinkage and warpage of the part, it is possible to analyze the impact that the process will have in the final assembly. Adjusting the design and the process is possible if any problem is anticipated. Even if this process would require extensive analyses, it is possible to test it. Spending some time at this stage by doing different iterations is better and cheaper than solving a problem during production.

This approach has been implemented and tested in engineering groups. At early stages, there is no need of having highly trained and developed experts in Rheology simulation. The used results are obtained from basic simulations. It is not needed to spend a lot time to have accurate results. Engineers doing the analyses need to have a good perspective of plastic part behavior, and they need to be capable of making decisions about product development.

A good result can not be obtained without sharing and collaborating. A collaborative environment between the tooling engineers, manufacturing engineers, design engineers and the different actors in all stages of product development is the basis for getting better solutions. It is hard to have someone doing all the jobs, different points of view always help. The experience of the different groups can enrich the knowledge and of course, the final result.

This different way of using Rheology simulation has been widely used in different projects at Schneider Electric. It has shown to be a good way to reduce the development time. It is part of a continuous way of changing and acquiring new product development methodologies. The results have been good, and the challenge is always to make them great.

For more information contact Silvestre Cano, Schneider Electric at +52 (81) 47 39 21 33 Ext. 84533 or via e-mail silvestre.cano@schneider-electric.com.

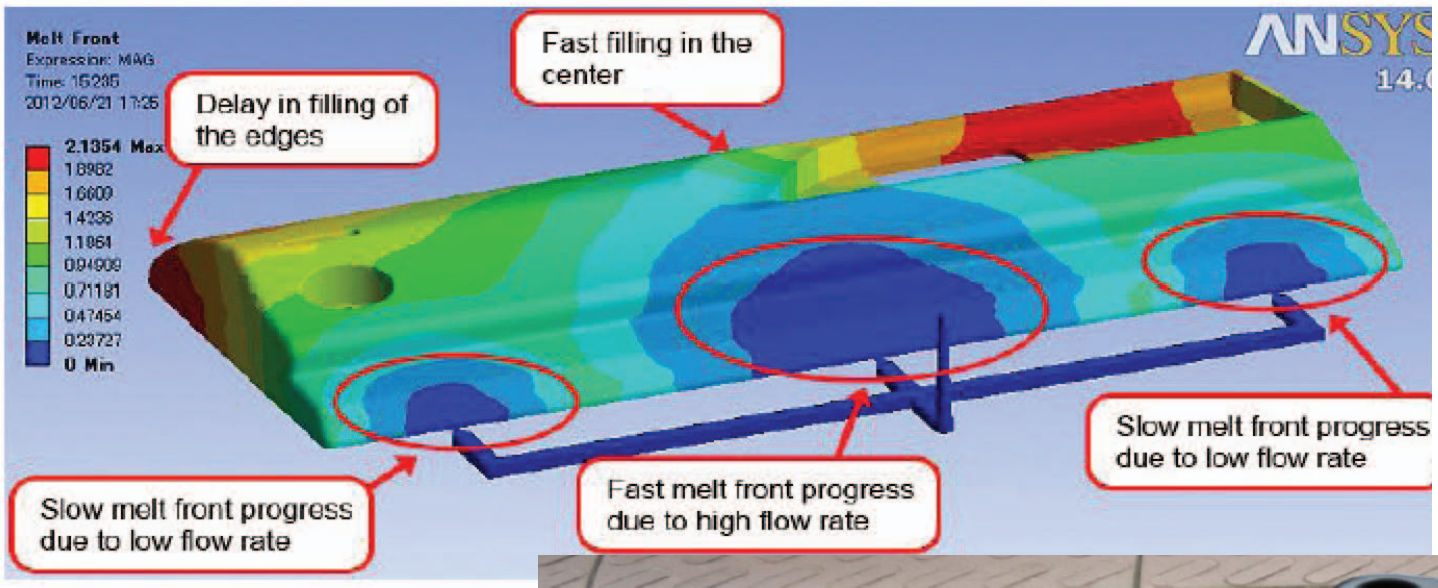
Feature: Improving Surface Finish and Part Performance

By John Blundy President
HRSflow North America
john.blundy@hrsflow.com
248-762-3710
www.hrsflow.com

Improving Surface Finish and Part Performance in Injection Molded Parts

The art of sequential molding is well known and proven to be a beneficial process in many markets where injection molding is used. Automotive suppliers are one of the largest user's, of this technology, especially for the production of class "A" surface finish plastic parts.

The original purpose for the use of sequential molding was to reposition or remove weld or knit lines. These conditions occur when melt flow fronts collide in a mold cavity. A poor knit line can cause cosmetic blemishes

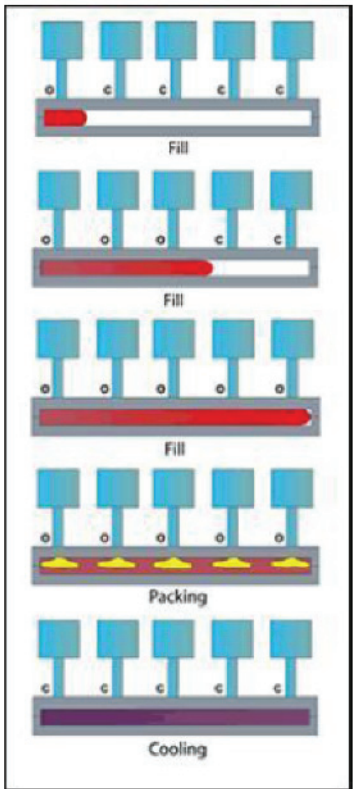


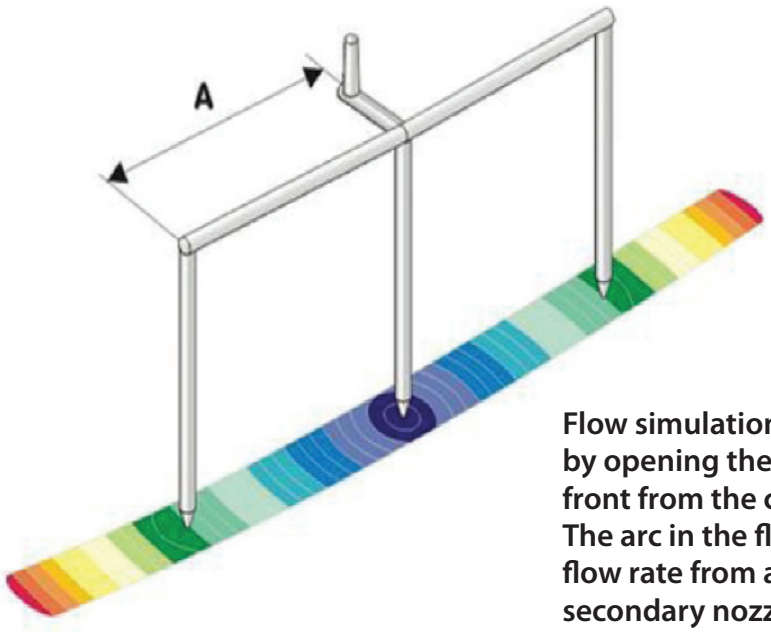
Feature: Improving Surface Finish and Part Performance Continued

and it can significantly weaken the structural integrity of a part. Strength at the knit line can be as little as 20% of the nominal strength of the part.

Weld lines also can be visible after a part is painted and therefore unacceptable, and also can be the cause of wrinkles for in-mold label injection molded products. By sequencing the valve gate operation, weld lines can be manipulated to a more desirable position, or in some cases eliminated. However, there are still conditions when using sequential molding where visual imperfections can occur on the part between nozzles and/or near the gate itself. These flow marks or hesitation lines appear on the surface of the part. The material flow hesitation is created by the very sudden change in pressures as the melt from the first valve gate nozzle is introduced into the cavity at an initial high rate of velocity. As the material from the second valve gate nozzle enters into the cavity, backfilling can occur between the nozzle entry points. The quick initial pressure rise then dissipates, causing the "hesitation." mark.

This condition is typical in the operation of standard valve gate designs. The only opportunities for improving the outcome can be process technique, although this is often not successful, or to reposition the valve gate nozzles. The later method is both costly and time consuming requiring mold rework.





Flow simulation shows the change in flow velocity caused by opening the outer pair of VG nozzles once the flow front from the center nozzle reached the outer nozzles. The arc in the flow isochrones (green) shows increased flow rate from a sudden "blast" of material from the secondary nozzles.

Feature: Improving Surface Finish and Part Performance Continued

Sequential molding can also reduce clamp-tonnage requirements as compared with filling a mold cavity through all gates at once. Pack and hold can be profiled with greater precision, supplying more intense packing to just those areas that require it.

Other areas such as family molding, co-injection, over molding, and gas assist also can benefit with the use of sequential molding techniques.

Control technology has been improved over the years contributing to the success of the sequential molding process,

Hot runner components also have realized improvements in heater and component material performance which have helped to improve quality and repeatability.

Also, the introduction of cavity event devices, such as pressure and temperature transducers, have allowed molding technicians the ability to fine tune a process for consistent part quality.

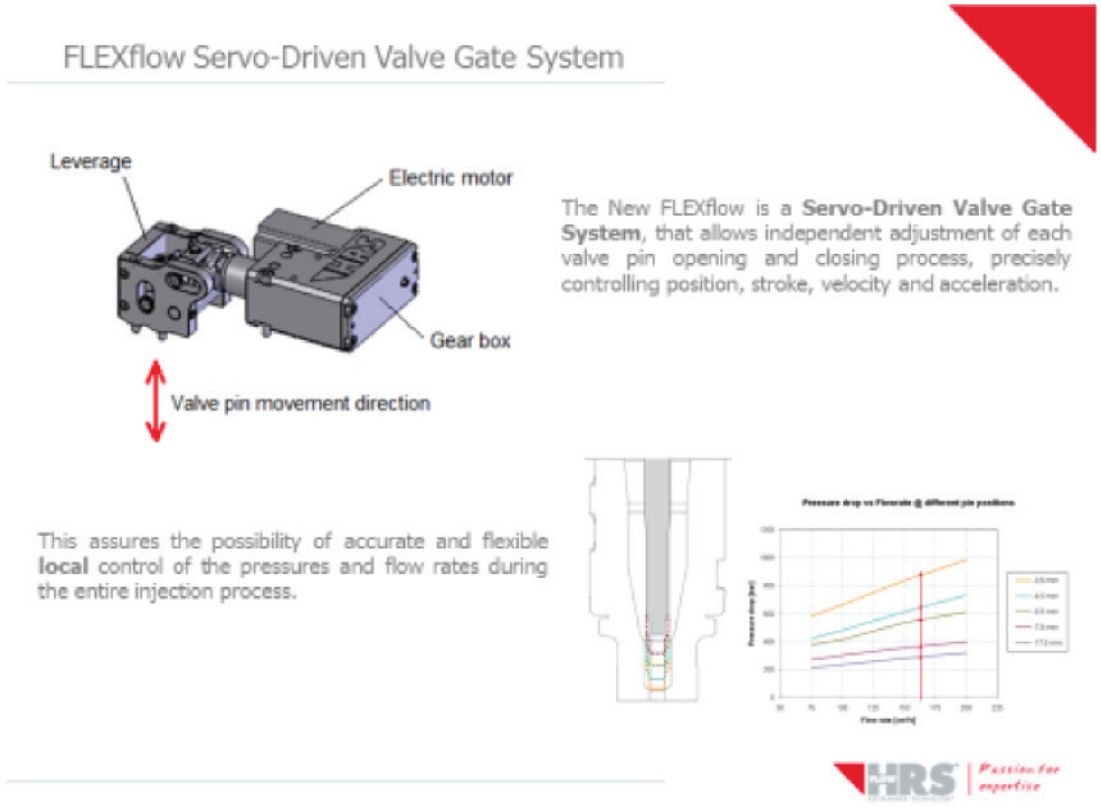
As shown there are still molding problems that sequential molding has not fully eliminated and the demands from automotive manufacturers and other markets supplying large injection molded parts are continuously searching for technology that provide improved part performance and cosmetic appearance.

Feature: Improving Surface Finish and Part Performance Continued

The purpose of this paper is to introduce the next innovation for improving the process of sequential molding. The product is a development of HRS, and trade named FLEXflow.

The principal improvement centers on the use of Servo-Motor technology. This is not new to valve gate operation, however in the past, Servo-Motors could only be used in small part molding applications due to limited power output. What makes this system different or improved is the higher force the new motor is capable of.

The early motor designs did not produce enough force to over-come the plastic pressure realized on the face of the valve pin required for large injection molded part applications. This resulted in an unacceptable witness on the molded part. As a result valve gate systems used for the production of large injection molded parts remained with hydraulic operation due to the force these systems can generate, until now.



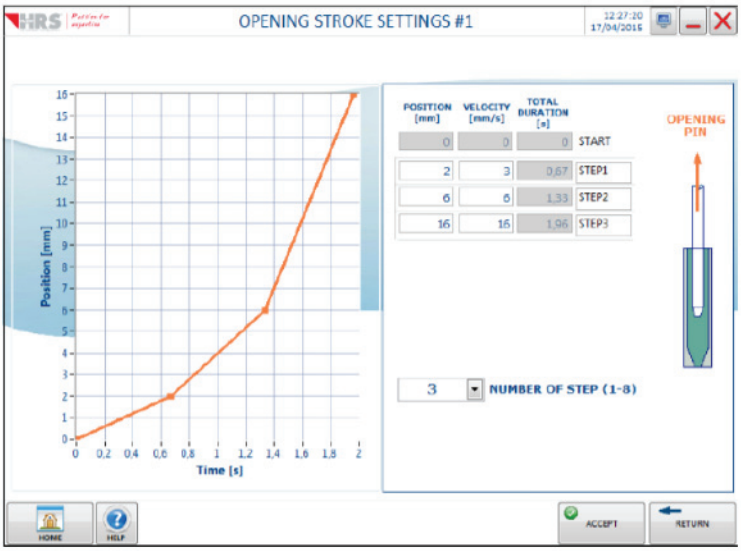
The servo-motor operation is directly transferred to the valve pin stroke. A specially designed control system thus accurately programs the valve pin in 8 distinct positions with varying velocity, and pressure in both the opening and closing phase of operation. This provides optimized plastic flow control from each valve gate nozzle into the molded part. By precisely varying the effective orifice size, plastic flow is controlled at a consistent volume. The position accuracy provided by the servo-motor delivers an accurate and repeatable result not previously available before the development FLEXflow technology.

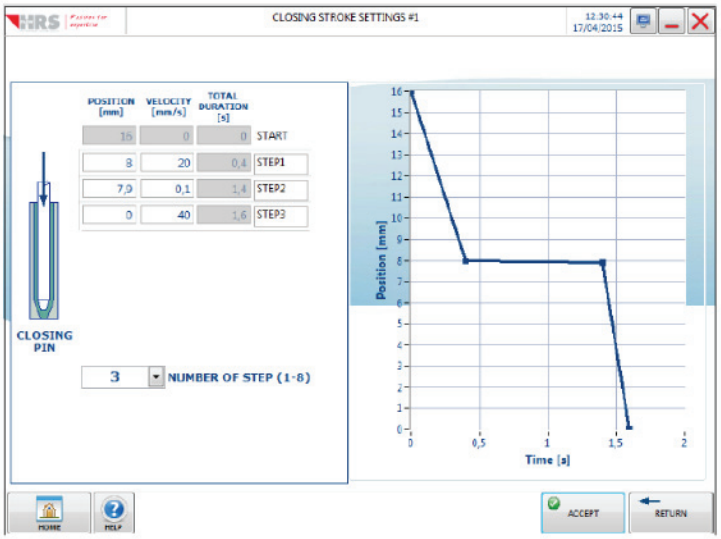
Feature: Improving Surface Finish and Part Performance Continued

The precise control of pressure and flow rate during cavity filling ensures inner tool pressure to build more evenly and without the sudden pressure drops that occur in conventional systems. Pressure transducers can also be incorporated to monitor the packing phase for managing a repeatable process.

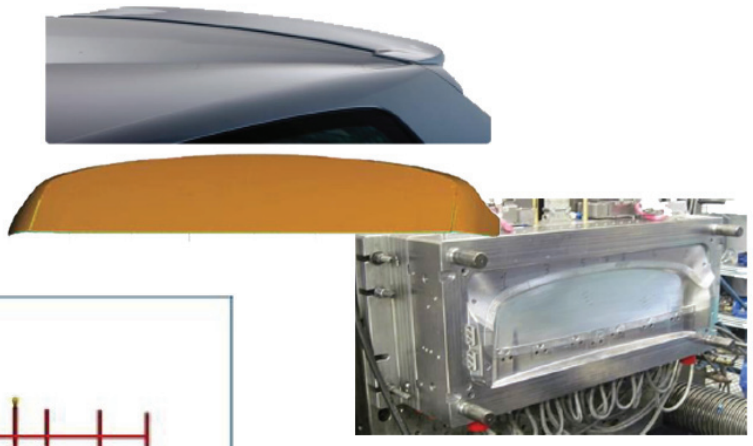
The FLEXflow system delivers a more consistent and lower filling pressure than achievable in conventional sequential injection molding technology. This, process-ability dramatically improved component quality, since the molded parts realized much lower in-molded stress and thus, substantially reduced the tendency to warp.

Part weight and clamp force reductions are also achievable using the FLEXflow technology.



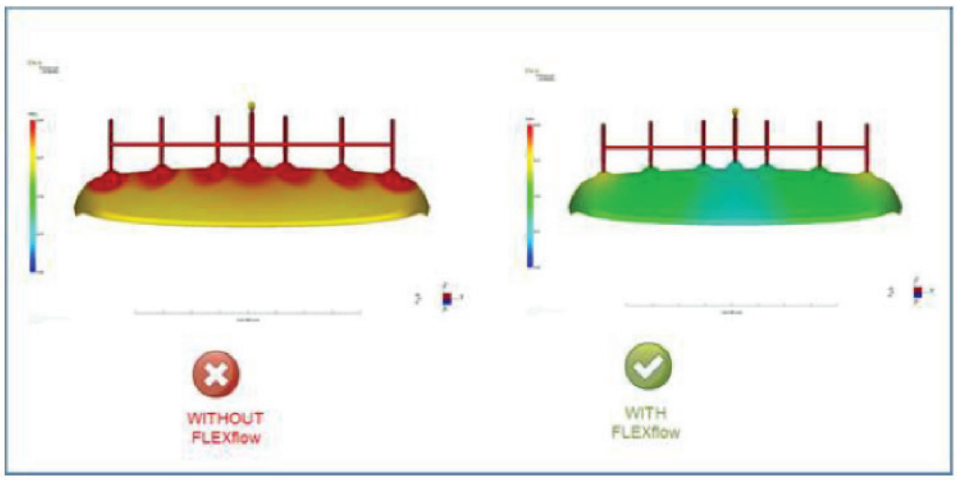


As shown in the graphs, pin movement over the entire stroke has minimal to no effect on cavity pressure.



Pressure distribution during packing, comparing FLEXflow and conventional system.

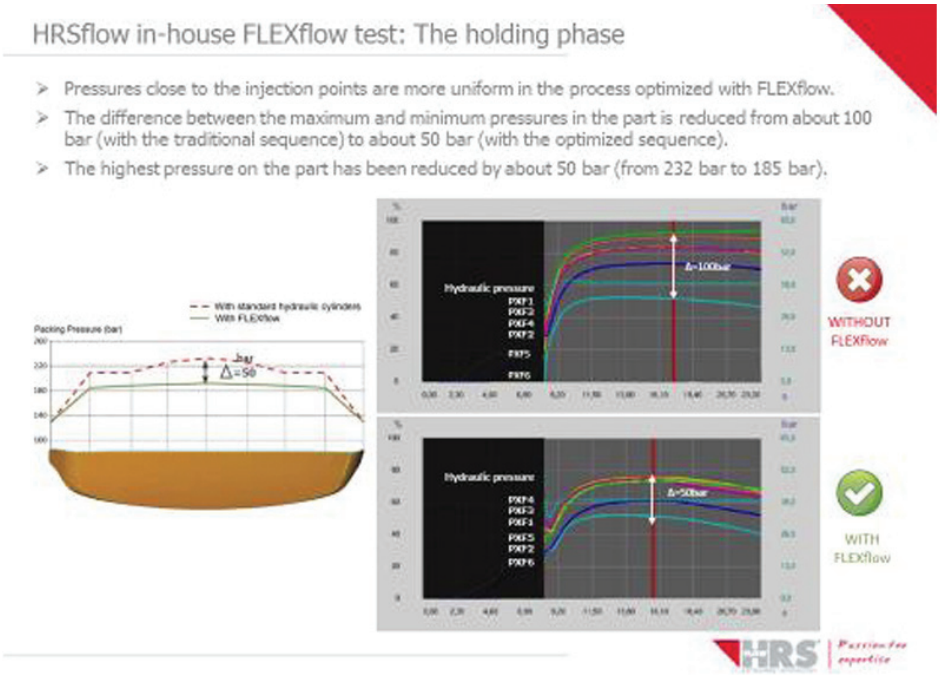
Image courtesy of HRSflow/Moldflow.



Feature: Improving Surface Finish and Part Performance Continued

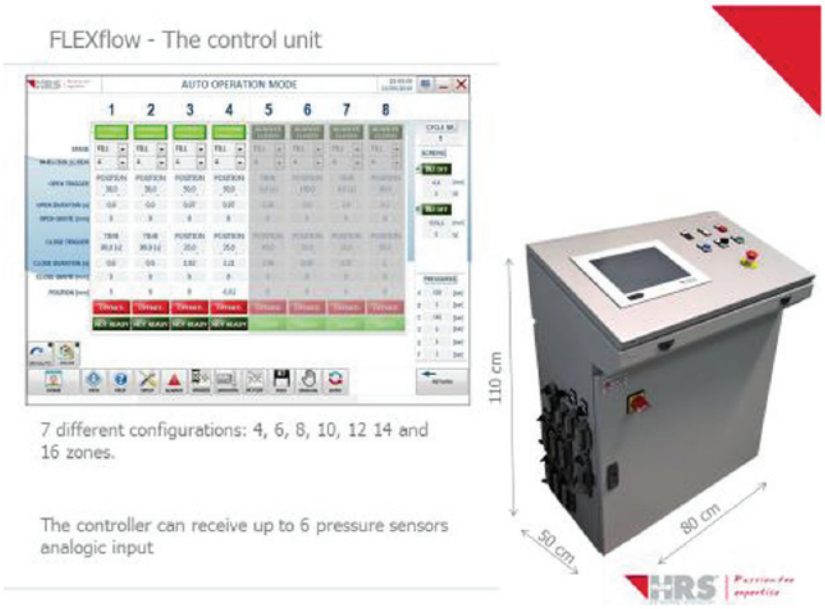
In order to further prove the FLEXflow advantages a spoiler test mold, identical in design and construction of a roof spoiler production mold was produced. The component, measuring 1,260 x 280 x 120 mm with a wall thickness of 4 mm, is molded from a PP/EPDM compound with 20 % talc. The mold is equipped with 7-drop FLEXflow system and 7 pressure transducers located directly opposite nozzle and at the end of the flow path, in the middle part or on the outer end of the component.

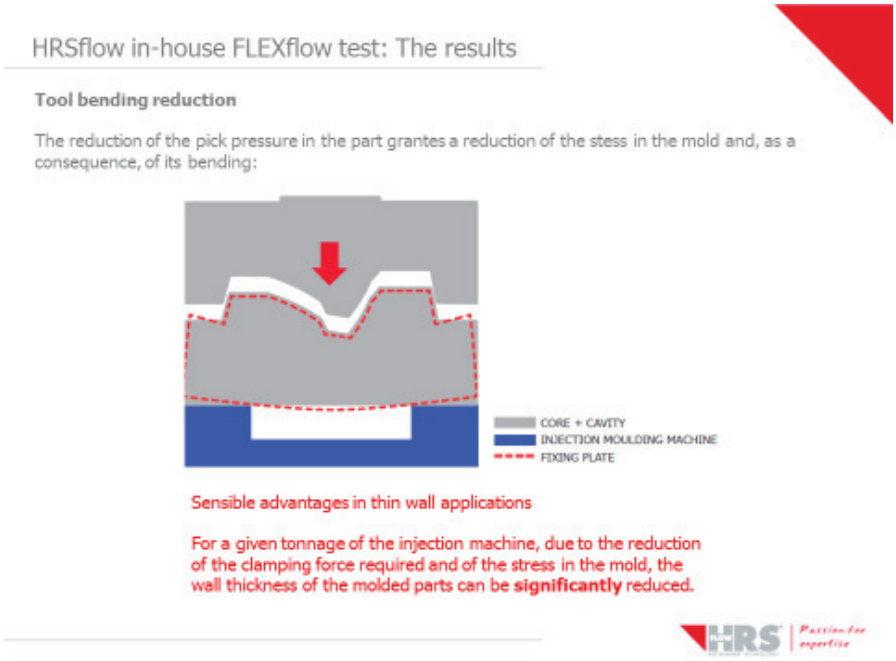
The new FLEXflow hot runner systems improved surface finish of the molded parts compared with earlier systems. An unexpected benefit realized was weight reduction of up to 5 %. This is a direct result of uniform filling pressures which results in less packing pressure. Following this, is a reduction in clamp force requirement. Results achieved were a 20 % reduction providing the potential to downsize injection molding machine size.



Feature: Improving Surface Finish and Part Performance Continued

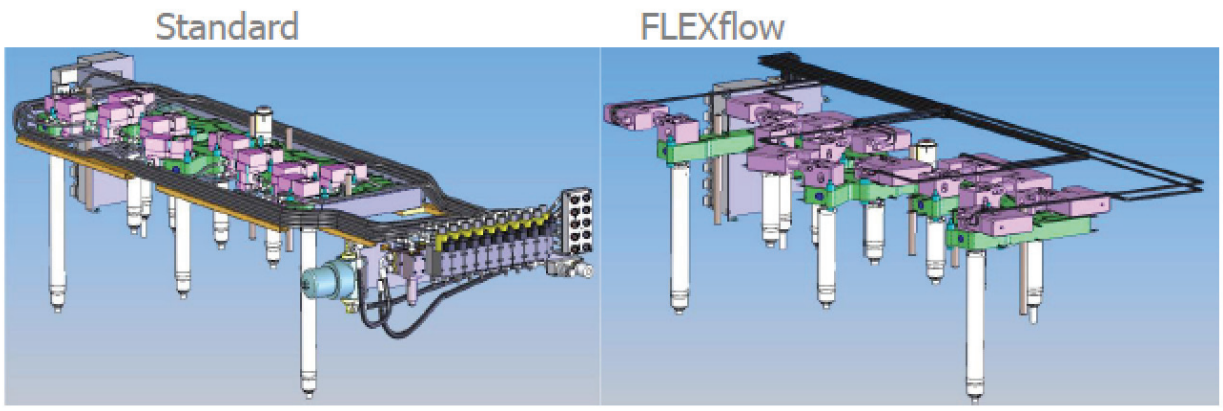
The eight valve pin - opening and closing — positions are available for each one of the nozzles with a precision up to 0.01 mm. Valve pin stroke, can also be fine-tuned for speed and acceleration. The settings are configured through a control system uniquely designed for the purpose. Currently, up to 16 hot runner nozzles can be individually controlled.





Reduced injection pressure and a more consistent pressure distribution during the holding phase results in the maximum internal cavity pressure of the spoiler mold to be decreased by about 50 bar (725.19psi), as compared to the conventional process. This significantly reduces tool deflection thus improving mold life.

Feature: Improving Surface Finish and Part Performance Continued

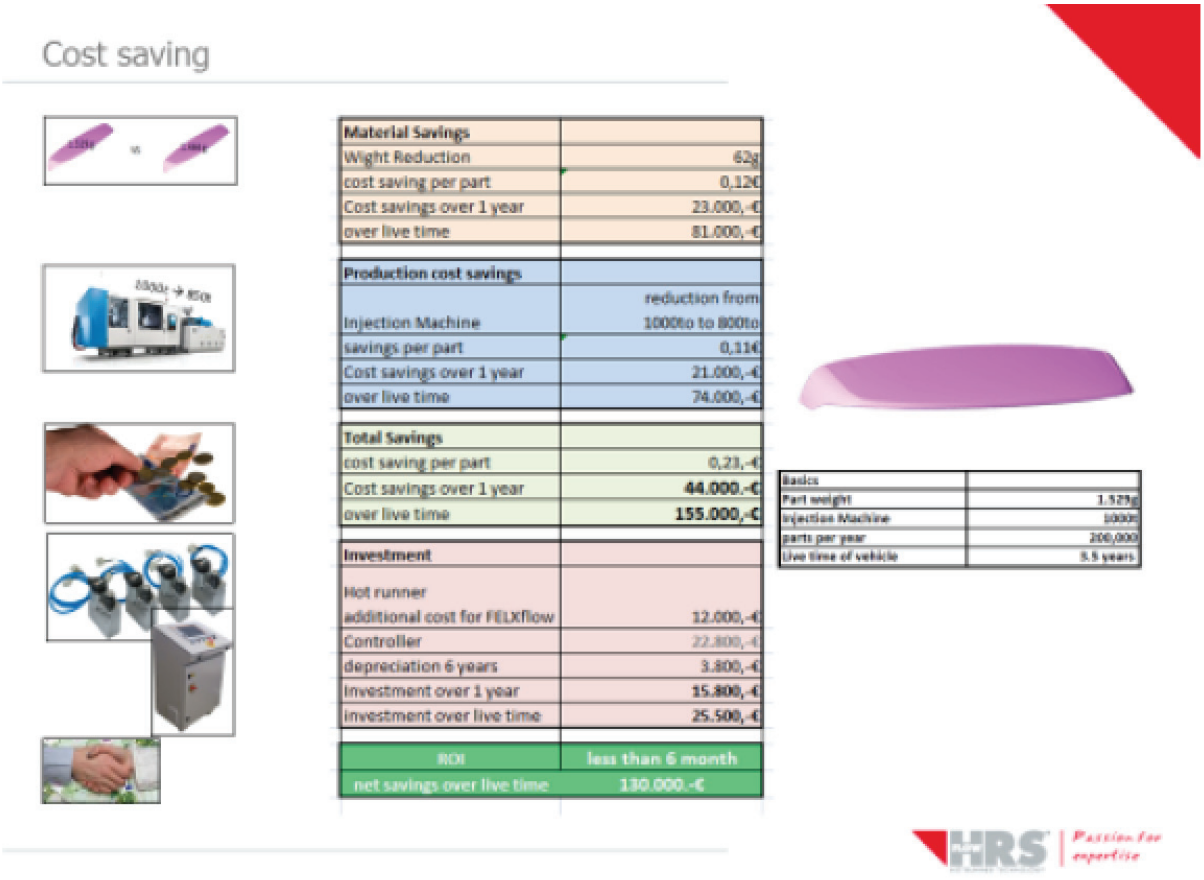


FLEXflow systems also provide operational advantages as compared to conventional hydraulically operated valve gate hot runner systems. They include:

- Compact system (reduced mold height)
- No water pipes or connections (leaking)
- No oil tubing or connections (leaking)
- Increased contact with mold (motors can be side-mounted)

An important consideration attached to any technical improvement is the cost of implementing the technology in practical applications. Using the part produced from our test mold with FLEXflow technology and applying market cost data we can calculate the following savings.

For more information contact John Blundy, President HRSflow North America at 616 228 6894 or via e-mail john.blundy@hrsflow.com. www.hrsflow.com



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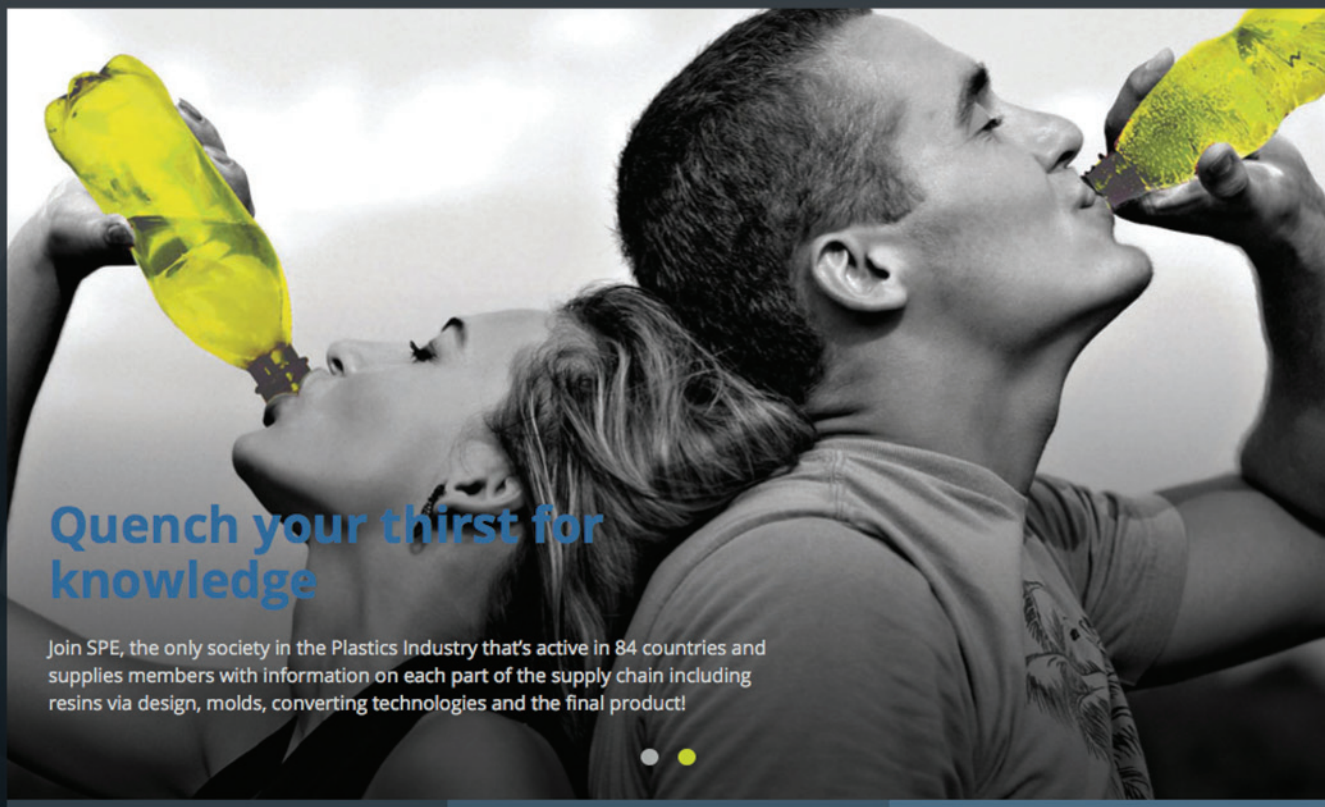

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By Mark A. Spalding, The Dow Chemical Company, Midland, MI
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Rebuilding Screws for Injection Molding Process

Improper rebuilding of screws for injection molding plasticators can lead to screws with high wear rates and the formation of resin degradation products. Resin degradation can cause black specks and color streaks in injection molded parts, reducing the yield and profitability of an injection molding process. This paper presents two problems that occur when injection molding screws are not rebuilt properly.

Introduction

Injection molding processes must be able to operate at low cycle times and high yields to remain competitive in the market place. Once a process is optimized for rate and thus minimum cycle time, loss of yield can reduce the profitability of a plant. Yield can be reduced by off dimension parts due to improper shrinkage[1], short shots, loss of cushion, surface defects known as splay [2-4], black specks, and color streaks [5] Moreover, screw wear at the flight tips will reduce the heat transfer coefficient and the specific rate (kg/[h rpm]) for plastication. Poor heat transfer and decreased specific rate have the potential to cause the temperature of the injected material to increase, leading to longer cooling times and thus longer cycle times. If the cycle time increases, the profitability of the press will decrease. When the cycle time starts to increase due to wear, the processor will typically remove the screw, replace it with a spare screw, and have the worn screw rebuilt to the original specifications.

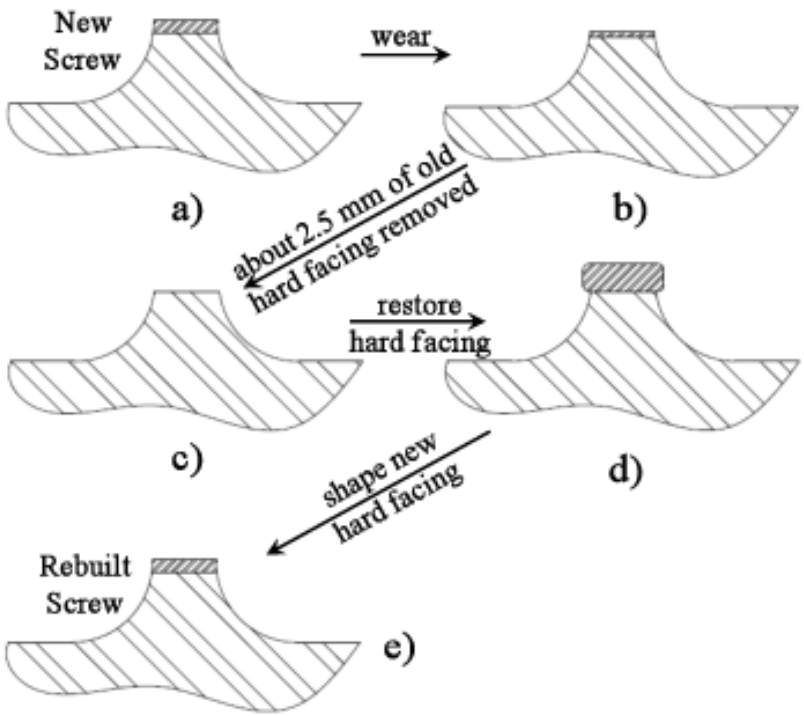

Figure 1: A proper rebuilding process for flights: a) original flight specification, b) a worn screw, c) some of the old hard facing is removed by the screw fabricator, d) the new hard facing is applied, and e) the restored flight with new hard facing.

High quality screw fabricators can rebuild the screw back to the original specifications using a multistep process[6]. This multistep process is shown schematically in **Figure 1**. The flight height as specified

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by the screw designer is shown in **Figure 1A**; i.e., a new screw. The flight clearance is typically about 0.1% of the barrel diameter. As the screw is used, wear will slowly remove some of the hard facing as shown in **Figure 1B**. The flight clearance could increase to 0.4% of the diameter or more before the processor decides to have the screw rebuilt. For the rebuilding process, the screw fabricator will remove some of the old hard facing using a grinding operation such that the flight surface height is decreased by about 1.3 mm, as shown in **Figure 1C** New hard facing is then applied to the flight tip in **Figure 1D**. Typically, the hard facing is applied using a plasma transfer arc (PTA) welding process. At this point, the hard facing is applied such that it is too high and overlaps the flight edge, as shown in **Figure 1D**. Next, the edge of the flight is milled off such that the flight radii are retained. Tool marks on the flight edges are then removed using a belt sanding operation. Belt sanding will be discussed in depth later. The edge milling procedure will typically cause the flight width to decrease by about 0.2 to 0.3 mm for a properly rebuilt screw. The screw is then ground to the specified outside diameter, as shown in **Figure 1e.** In most cases, the performance of the rebuilt screw is essentially the same as the new original screw.

Most screws are rebuilt using procedures similar to that shown in **Figure 1**. Careless rebuilding of screws, however, does sometime occur. When this happens, the service life of the rebuilt screw can be considerably less than the original screw. Moreover, the screw could be modified during rebuilding in such a way that resin degradation occurs. If resin degradation occurs, it will typically be observed as brown or black colored streaks or specks in the molded part.

The goal of this paper is to show how Moffat eddies can cause resin degradation at the flight radii, and how improper screw rebuilding can take a properly designed screw with excellent performance to a screw that develops Moffat eddies and resin degradation products or has a shortened service life. Case studies are presented that show these problems.

Moffat Eddies

Moffat eddies need to be understood before the concept of an improperly rebuilt screw can be presented. Moffat eddies [6-8] are recirculation flows or vortices that occur in sharp corners as shown in **Figure 2**. When a fluid is put in motion with top driven cavity flow the main circulation is shown in **Figure 2A**. This type of flow is very similar to the cross-channel flows that occur in the metering channel of a plasticating screw. Secondary recirculation flows are set up in the stationary corners of the channel, creating low velocity helical eddies that are outside the high velocity flows of the main part of the channel, as shown in **Figure 2B**. This flow region is commonly called a Moffat eddy[7]. The residence times in Moffat eddies can be very long, causing the degradation of thermally sensitive resins and difficulties in color changes and purging.

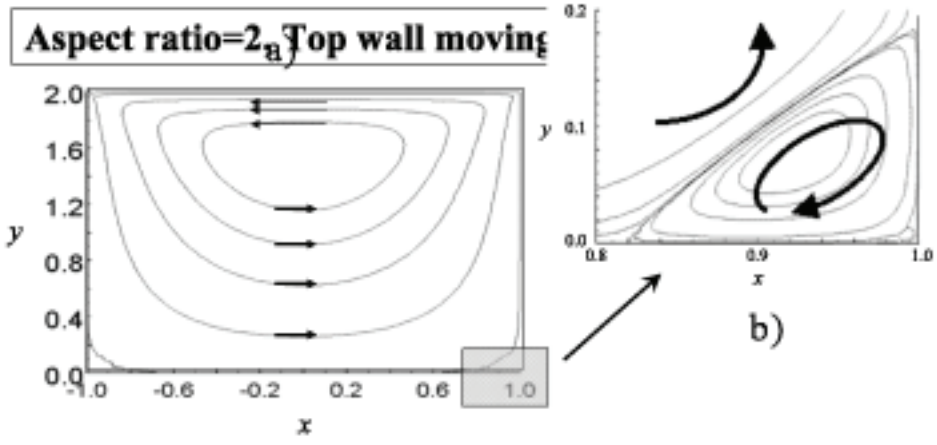


Figure 2: Cross channel flows for top driven cavity flow such as in a screw channel [6]: a) main flow recirculation, and b) low velocity helical flow or a Moffat eddy in the corner.

IMD Best Paper Continued

The Moffat eddy shown in **Figure 2** can cause the degradation of thermally sensitive resins. For example, degradation was observed at the flight radii for two different extrusion screws used to produce blown film from linear low density polyethylene (LLDPE) resins as shown in **Figures 3** and **4**. In both cases, degradation gels were observed in the extruded film products. A Maddock solidification experiment [9] was performed on the first case where screw rotation was stopped, full cooling was applied to the barrel, and the resin was solidified in the screw channels. Next, the screw and solidified resin were pushed out of the barrel and the solidified resin was removed from the screw. The solidified resin is shown in **Figure 3** along with the degraded resin at the radii of the flights. In the second case, resin flow to the hopper was stopped and the screw was allowed to rotate until resin flow at the die stopped. Next, the screw was removed hot. The photograph in **Figure 4** shows degraded resin at both the pushing and trailing flight radii.

The Moffat eddies formed because the flight radii were too small for the application. The flight radii (R) should be specified relative to the local depth of the channel (H) as shown in **Figure 5.** The ratio R/H is key to eliminating Moffat eddies. For the cases shown in **Figures 3** and **4**, the R/H was about 0.3 to 0.4. New screws with R/H values of 1.0 completely eliminated the degradation and Moffat eddies.

The Society of the Plastics Industry, Inc. (SPI) guidelines state[11] "unless otherwise specified the root radius will not be less than 1/2 of the flight depth up to 25 mm radius." Many screws are often designed, however, with flight radii that are very small and approach values that are between 10 and 20% of the channel depth. Previous research [10] has indicated that the SPI guideline as a minimum is appropriate for many resins. But for thermally sensitive resins, radii up to 2.5 times the depth are optimal. But due to the difficulty of fabricating large flight radii many screw manufacturers are not willing to provide this as a standard offering. Instead they may provide large flight radii at an additional cost.

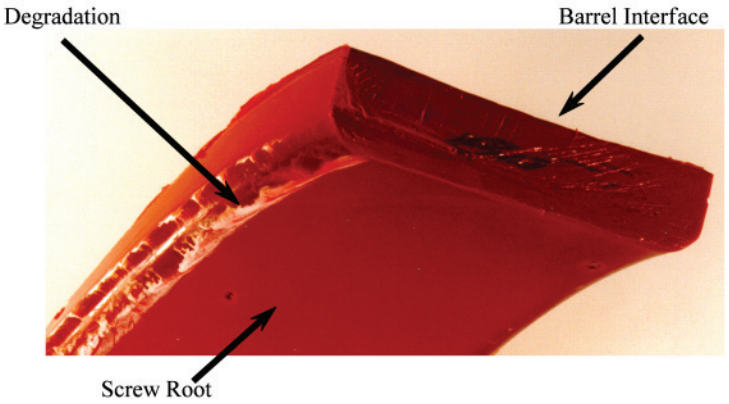


Figure 3: A Maddock solidification experiment revealed degradation at the pushing flight radius for LLDPE resin extrusion [10].

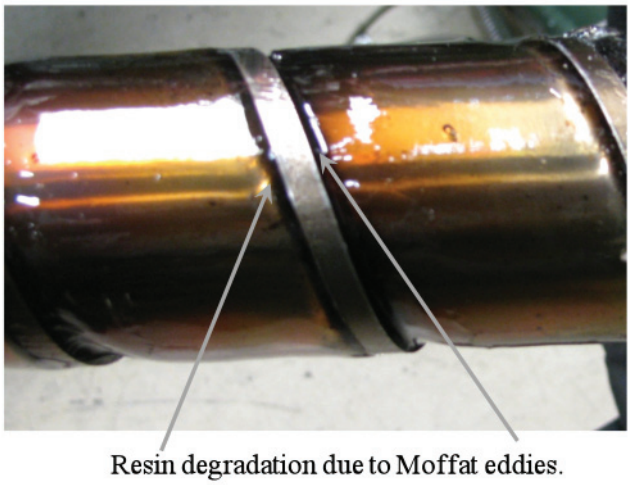
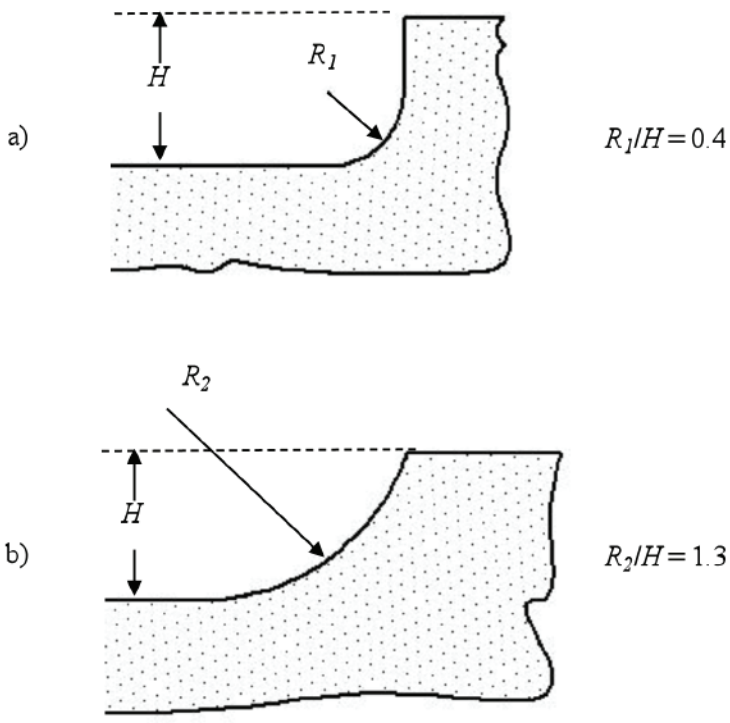


Figure 4: Photograph of a screw that was pushed out hot from the barrel, revealing resin degradation at the flight radii due to Moffat eddies.

IMD Best Paper Continued

Figure 5: Schematic of flight radii: a) small flight radius (R1) that would likely cause a Moffat eddy, and b) a large flight radius (R2) relative to the channel depth (H). R2 would likely not form a Moffat eddy.



As an example of Moffat eddies, a small interior automotive part was injection molded using a 700 ton press equipped with a 105 mm diameter single-screw plasticator[5]. The part was tinted beige by adding a level of color masterbatch to a polycarbonate acrylonitrile-butadiene-styrene (PC-ABS) resin. About 7% of the parts had to be scrapped due to black specks. A photograph of the part is shown in **Figure 6**. The scrapped parts were adding cost to the plant by reducing the yield, increasing resin consumption, and because a higher level of quality control inspection at the press was required.

The screw was removed hot from the barrel and examined. Resin degradation was observed at the flight radii in the metering section of the screw. The flight radii were about 20% of the channel depth; i.e., R/H = 0.2. For this application the flight radii should be at least equal to the local depth of the channel; i.e., R/H = 1. A high performance screw[6] with flight radii equal to the local channel depth was designed, fabricated, and installed into the press. The black specks were essentially eliminated from this process using this new screw. The large flight radii prevented Moffat eddies from forming.

Figure 6: Photograph of an automotive interior part that was scrapped due to black speck contamination [5,6] due to a screw that permitted the formation of Moffat eddies.

Screw Rebuilding

As previously indicated, care must be taken during the rebuilding process for injection molding (and extrusion) screws so that the performance of the screw as delivered by the original screw designer is maintained. This section provides two case studies where errors were made in the rebuilding process.

Flight Radii Size Changed During Rebuilding

An injection molding plant was producing specialty parts from a high density polyethylene (HDPE) resin. The screw as received from the original screw designer allowed the minimization of the cycle time (cooling rate limited in the tooling) and resin degradation was not observed in the parts. After a few years of operation, the screw had worn and the flight clearance increased to a point where the cycle time increased to an unacceptable level due to a longer cooling time. The screw was removed from the press and a spare screw from the original screw designer was installed. This spare screw had essentially identical performance as the first original screw when it was not worn. The worn screw was shipped to a local screw fabricator to be rebuilt. The rebuilt screw was returned to the plant and placed in storage.

After a few more years, the second screw started to show signs of wear as the cycle time had increased. Plant personnel decided to remove this screw and install the rebuilt screw. At startup, the rebuilt screw performed essentially the same as the original new screws. That is, the same short cycle time, the same specific rate (kg/[h rpm]) during plastication, and no resin degradation in the parts. After a few weeks, however, degraded resin started to appear in about 1% of the parts. The initial troubleshooting process indicated that the degraded resin was not coming from the resin manufacturing plant or from a recycle stream in the injection molding plant.

Plant personnel decided to remove the screw and inspect for locations where the degraded resin was originating. The screw was removed hot using the procedure detailed previously and used for the screw in **Figure 4.** Resin degradation due to Moffat eddies were clearly visible at the flight radii in the metering section of the screw. The screw and degradation was very similar to that shown in **Figure 4** except the level of degradation was considerably less. The R/H in the metering section was visually estimated at 0.4, a value too low for this resin. The R/H on the original screws was about 1.0 in the metering section, and resin degradation due to Moffat eddies was not observed in the parts made from the original screws.

In summary, the original screws had great performance with short cycle times and no resin degradation in the parts. After the screw was worn and then rebuilt, the cycle time performance was restored, but the screw caused the resin to degrade at the flight radii due to the formation of Moffat eddies. It was obvious that the flight radii had decreased during the rebuilding process.

The improper rebuild process that was used here was essentially the same as that described earlier in **Figure 1** up to the step in **Figure 1D**. That is, some of the old hard facing was removed from the worn screw using a grinding operation, and new hard facing was welded onto the flight. The next step is where the rebuild process was different. For the proper rebuild process, the edges of the flight were shaped using a multi-insert tool holder to produce the same radius as the original flight radius (or just slightly smaller). Tool marks on the flight edges were then removed using a belt sanding operation. This will retain the shape of the channel as specified by the original screw designer, as shown in **Figure 7E**. The channel in 7e will not cause resin to

IMD Best Paper Continued

degrade due to Moffat eddies. The screw rebuilder here, however, changed the radius of the flight by a combination of improper milling and belt sanding. Since both processes decrease the radii, it is impossible to determine which operation had the largest affect. This reduced the R/H from the original screw from 1.0 to 0.4, as shown by **Figure 7F** The flight radii for the rebuilt screw were too small and allowed Moffat eddies and resin degradation products to form at the flight radii.

Belt sanding is performed on all screws to remove very small machine marks from the surface of the screw. Errors made during belt sanding can reduce the flight radii size during the rebuilding process. A typical belt sanding operation is shown by the photograph in **Figure 8**. For this operation, the belt is forced against the root of the screw and the belt contours the shape of the screw root. If the operation is performed correctly, the radii size will be essentially unchanged and the surface of the flight edges will be very smooth. If the operator applies too much force to the belt or if the belt folds over at the radii, the size of the radii can be decreased very quickly.

Poor Application of New Hard Facing

The service life of a screw depends on many parameters including but not limited to the resin, hard facing, barrel liner, internal channel pressures, process conditions, and screw design. For example, resins that are loaded with inorganic fillers in general cause higher levels of screw wear and thus will have a shorter service life. If the hardness of the hard facing as measured by Rockwell C is less than specified due to poor welding techniques, the wear rate will be higher too.

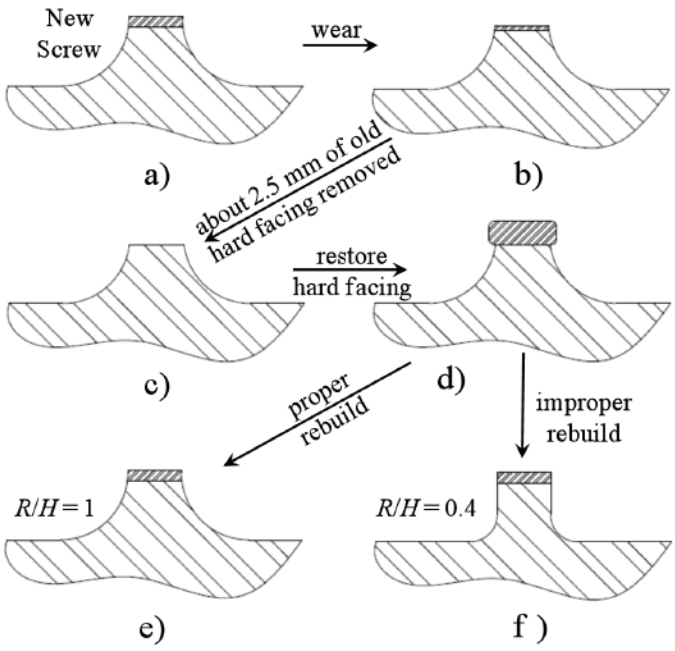


Figure 7: Proper and improper rebuilding processes for flights: a) original flight specification, b) a worn screw, c) some of the old hard facing is removed by the screw fabricator, d) new hard facing applied, e) the restored flight with new hard facing and proper flight shaping (proper rebuild), and f) improper flight shaping due to excessive belt sanding, creating a flight radii that are about one half that of the original flight radius.

Figure 8: A photograph of a belt sander used to perform the final finish of the channels. The side guard has been temporarily removed to show the sanding belt.

Photo courtesy of Jeffrey A. Kuhman of Glycon Corporation.

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An injection molding plant that was running a specialty resin was experiencing service lives for some of the screws that were about half that of the original designer built screws. Personnel at the plant decided to have a different fabricator rebuild the screw. The new fabricator was told about the short service life span of some of the screws. Upon examination, the old screw had a very poor welding of the hard facing material on the flight. This poor welding caused high levels of porosity in the hard facing metal, as shown by the photo in **Figure 9**.

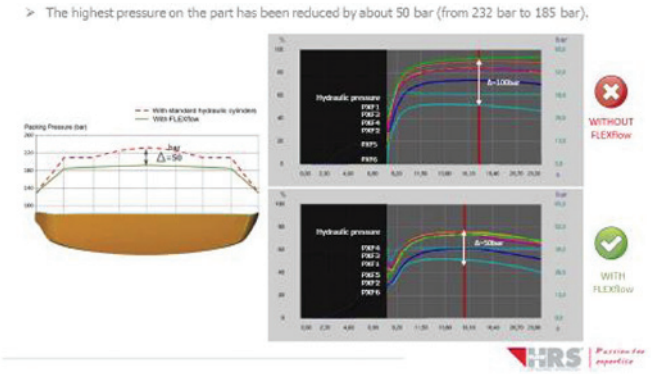

Figure 9: Photograph of a metering section of a screw used for injection molding. The voids visible in the hard facing indicate the weld is poor quality, porous, and not as hard as a high quality weld.

Voids in the hard facing can occur if the PTA welding process is not performed properly. During the PTA process, the welding area is blanketed using an inert gas, typically helium or argon. If the gas flow rate is acceptable, then the hard facing will be applied without voids. If the gas flow rate is too high, however, some of the gas will become entrained in the metal powder hard facing feedstock, eventually creating voids in the hard facing of the flight. The voids are clearly visible in the hard facing shown in **Figure 9**.

Discussion

Improper screw rebuilds that lead to reduced flight radii sizes as shown in **Figure 7** are not a common problem, but they do occur in the field. It is recommended that the screw owner request that the rebuilder maintain the flight radii size as part of the agreement, especially for a first-time rebuild with a new fabricator. When the screw is returned to the plant, the screw should be inspected for flaws including flight radii size before the screw is placed into storage.

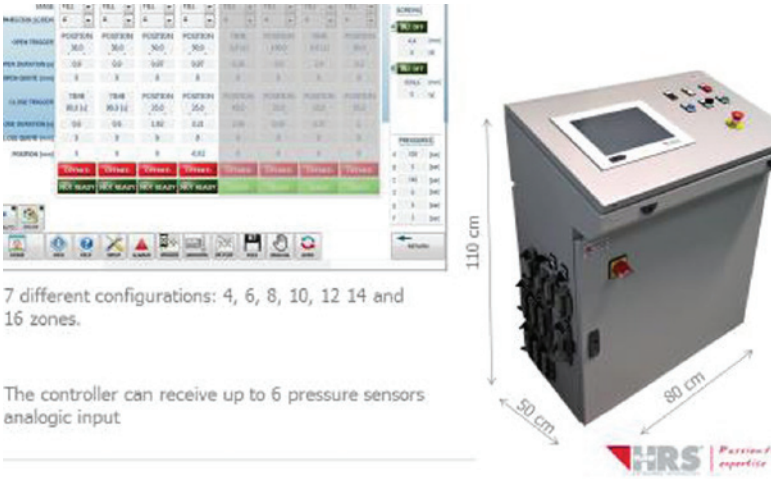

Figure 10: Photograph showing the grinding of the excess hard facing from the flight edge during screw rebuilding. Photo courtesy of Precision Feedscrews Inc.

Grinding processes are becoming a preferred method for trimming excess hard facing from the flight edges. For this process a grinding wheel is positioned so that just the excess hard facing and a very small amount of the base metal are removed during the finishing operation, as shown in **Figure 10**. Since the grinding wheel only operates at the top of the flight, the flight radii size will not be decreased during the procedure. If the grinding is done properly, only minimal belt sanding will be required to remove fine scratches from the grinding process.

IMD Best Paper Continued

As previously mentioned, screws with small flight radii that create Moffat eddies not only allow resins to degrade, they also require longer times to purge between color changes or resin changes. The longer purge times are created by the long residence time of the older resin in the eddies. Screws that do not form Moffat eddies will purge in a significantly shorter time period.

Since some of the base metal on the flight edges is removed during the process, the screw can typically be rebuilt up to three times before the flight width becomes too small and too stressed and brittle for practical operation. The embrittlement of the base metal is due to successive dilution of the hard facing material into the base metal during each rebuild. Eventually during the final outside diameter grinding process, the friction between the grinding wheel and the hard facing causes the hard facing to delaminate within the dilution zone of the flight weld. After the third rebuilding process, the flights are typically brittle to the point where they should not be rebuilt again.

The flight radii size in the solids conveying zone and early into the melting zone can be reduced via erosion for some engineering resins that are filled with high levels of fillers such as glass strands[12]. The erosion is observed on the pushing flight and it is caused by the high pressure at the surface and the abrasive nature of the filled resin. Often a good screw rebuilder will weld the area that was eroded away with a high carbon welding rod or apply a hard facing material such as Stellite 6 during the rebuilding process.

Although the case studies shown here were for screws built for injection molding machine plasticators, the problem also occurs for extrusion machines. That is, the recommendations provided here are applicable to screws designed and built for extruders.

Conclusions

Improper rebuilding of injection molding screws can cause the flight radii in the metering section to be reduced to the point where Moffat eddies can form. These eddies can cause resin to degrade due to long residence times in the eddies, leading to degradation products in molded parts.

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IMD Newsletter
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SPE IMD Councilor Report

October 9-11, 2015

Pittsburgh, PA

Submitted by Susan Montgomery, IMD Councilor

SPE President Dick Cameron welcomed all councilors. He emphasized the need for SPE to become relevant by bringing more value for our member base. We were encouraged to plan relevant events for educating our members and attracting new society members.

Brian Landes (from EC) has been appointed to head an Awards Task Force. Jon Ratzlaff, Chair of the ANTEC Parts Competition had comments regarding ANTEC's 2016 Parts Competition theme:

protect life, quality of life, improve life and sustain life.

Financial Update: Wim DeVos, SPE CEO (Chief Staff Officer)

Wim contrasted revenues from past ANTECs and memberships with recent numbers:

Past ANTECS: 4,000 attendees/$2MM; **Past Memberships:** 35,000 members/$3.5MM

Recent ANTECS: 1,500 attendees/$800,000; **Recent Memberships:** 14,000 members/$1.4MM

Wim discussed a business model based upon non-dues based revenues. Some of these revenue streams include website ads, Chain ads, Top Cons and other events, P2P seminars, The Plastics Race and others.

IMD Councilor Report Continued

Decision made to hold future ANTECs at hotels so that the conference rooms are free of charge.

Forecast 2015, SPE is ($147,000). Many website enhancements and other improvements were made and are in process of being paid for.

Regarding NPE 2015: SPI profit share was 45%, has been re-negotiated to 25%. SPE was not responsible to pay for the OCCC facility. This expense was covered by SPI.

Regarding events, tax policy: SPE will obtain 12% from Top Con and other event revenues. Any Sections or Divisions organizing events are encouraged to utilize the free resources available from SPE HQ.

SPE HQ now has a staff of 12, down from the staff of 30 persons prior. Sarah Sullinger and Barbara Spain resigned. There are two new open positions: IT Manager and New Business Development Manager. Russell Broome and Wim are conducting interviews.

Communications Update: Wim and Russell Broome, SPE Managing Director

- **ANTEC:** Concept is that "a little bit of everything" is offered. HQ feels that Top Cons are more successful as they are very focused on certain subjects.
- **SPE website:** Divisions are encouraged to have their websites hosted on SPE's website. SPE is using "responsive" design so that the website is accessible for computer, tablet and i-phone devices. Cost to maintain is $500 per year.
- **SpecialChem:** Product database of over 80,000 materials will be available for SPE members to access by the end of October or beginning of November. Also working as co-owners and co-producers with SpecialChem on video tutorials targeted to feature technical expert problem solving.
- **SPE/ Paulson/Penn College of Technology:** Training discounts to members
- SPE Consultants Circle on website, for SPE members, $200/yr to post
- **Industry/Academia Collaborations:** Chair, Vicki Flaris

- **Highlighted New Resources from SPE HQ:**
  - **Plastics INSight Newsletter:** Focused content industry newsfeed. Customizable content for the user. Follow certain publications, markets, processes, equipment, services. Currently soliciting companies to advertise. Best practice for ads (size, pricing) is available. Revenue share for Sections and Divisions who bring interested partners.
  - **e- Touches:** New software available for all aspects of event planning, promotion, organizing, follow up. No charge to use the product. Contact Sue Wojnicki at HQ.

Break-out Session: SPE Products available to Divisions and Sections: for information:

Plastics INSight Newsletter, Ad and Marketing Opportunities: Russell Broome, rbroome@4spe.org

Foundation Opportunities

- **Scholarships and Grants:** Gene Havel, ghavel@4spe.org
- **PlastiVan:** Margie Weiner, mweiner@4spe.org

IMD Councilor Report Continued

Head Quarter Resources, Leadership Opportunities and Website for Sections and Divisions: Kathy Schacht, kschacht@4spe.org

The Chain: Liz Martland, lmartland@4spe.org or Scott Owens, sowens@4spe.org

Top Cons: Sue Wojnicki, swojnicki@4spe.org

Video Tutorials: Carine Roos, croos@4spe.org

Governance Task Force Update (GTF)

Task Force Members: Scott Owens, Paul Browitt, Cor Janssen, Sandra McClelland, Sergio Sanchez, Scott Steele, Dick Cameron

SPE Governance structure is being re-designed for better efficiency and effectiveness. Basic premise is that a smaller group of functionally qualified and accountable individuals, would provide the necessary direction and oversight of Society governance matters, enabling Chapters to focus on projects consistent with the Society objectives, for example, member value, education, etc.

The Governing Body (GB) shall provide direction and oversight of all Society governance matters.
Council shall have authority to overturn by-law & policy actions implemented by the Governing Body (2/3 majority vote of Council required).

The GB shall be comprised of ten (10) individual SPE members plus the Chief Staff Executive.
The GB members are elected by a combination of Council and SPE members according to GB position.
The interests of the Society are best served when The GB is comprised of cross functional and qualified Individuals. Group meets monthly, five times face to face, once per year face to face with Council.

Proposed GB positions and terms:

- President, 1 yr, Progression
- President – Elect, 1 yr, Elected by Council
- Past President, 1 yr, Progression
- VP Sections, 2 yr, Elected by Council
- VP Divisions, 2 yr, Elected by Council
- VP Young Professional, 2 yr, Elected by Council
- VP Finance & Business, 2 yr, Elected by Council
- VP Events, 2 yr, Elected by Council
- VP Marketing, 2 yr, Elected by Membership
- VP Education, 2 yr, Elected by Membership
- Chief Staff Executive

Much good discussion took place during COW (Committee of the Whole) chaired by Sandra McClelland.
Some of the issues brought up as follows:

- Is this organizational structure becoming more like a "for profit" organization? (like SPI)
- How are nominations and elections held?
- What is the role of Council moving forward?
- Is the structure already set?

IMD Councilor Report Continued

The GTF mentioned that the new governance structure is a "work in progress." There are opportunities for the membership to provide input and suggestions as to how things move forward.

One note, just a "straw poll" of Councilors: majority agreed 10 GB persons is a good number for adequate representation. Only a few desired more or less positions.

The GTF will meet again in two weeks. They welcome comments/questions/concerns. ***Please send your comments or concerns to me: Susan Montgomery, IMD Councilor, susan.montgomery@lubrizol.com***
I will be very glad to convey the information to GTF.

Membership and Elections: Wim DeVos

Our membership is growing. SPE now has 16,600 members. The e-membership has grown, now at 3,000 e-members.

For EC elections, Wim suggested that Council move to electronic elections. This is part of the e-Touch software package and can be implemented for secret ballots. Nominations will be called for from the floor.

Student Activities at ANTEC: Len Czuba

Committee includes Len, Brian Young, Jaimie Gomez.
Support is requested from Sections and Divisions only.
Levels of support:
Bronze: $750 (2 student luncheon tickets)
Silver: $1500 (4 student luncheon tickets)
Gold: $2000 (6 student luncheon tickets)
Platinum: $2500 (8 student luncheon tickets)

ANTEC 2015 there were 50 unused luncheon tickets. Len encouraged everyone to pass tickets on to others who will use them.

ANTEC 2016 Student Activities support from IMD will be addressed at the next IMD BOD meeting in January 2016.

Sections/ Divisions Business: Rodney Joslin

Sections Abandoned: Central and S Florida, Arkansas
Division to Provisional: Electrical and Electronics
New Student Sections: University of Toledo, Nan Yang University
New Sections: ASEAN, Middle East

Rodney was elected as Sections Chair for another term.

IMD Councilor Report Continued

By-Laws Committee: Bruce Mulholland

The following were voted upon and passed by Council:

- **7.3 and 7.4:** Allows for electronic voting
- **Policy 023:** Nominating Committee: allows for electronic voting
- **Article 4:** concept of e-members: no voting rights
- **Policy 002:** Student members, e-members, honorary members: not included in rebate
- **Policy 012:** "Chief Staff Executive" wording
- **Policy 010:** use of SPE logo, follow guidelines
- **Article 13:** Chief Staff Executive may use Chief Executive Officer as a job title

Logo Discussion:

Red logo will remain in style guide and can be used.

NEXT COUNCIL MEETING: Virtual meeting, Friday, 2/5/2016

COMMENTS, QUESTIONS, CONCERNS ARE ENCOURAGED. PLEASE SEND TO:
SUSAN MONTGOMERY, IMD COUNCILOR
susan.montgomery@lubrizol.com

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IMD Board of Directors Meeting

October 4, 2015

Troy, MI

Submitted by Hoa Pham

The IMD Chair, David Okonski called the meeting to order at 9:00 AM ET.

Roll Call

Hoa Pham, acting as Secretary for Srikanth Pilla, conducted the roll call.

Present were: David Okonski (Chair), Hoa Pham, Brad Johnson, Rick Puglielli, Tom Turng and Susan Montgomery.

Teleconference: Srikanth Pilla, Raymond McKee, Nick Fountas, Jack Dispenza, Jim Wenskus, Peter Grelle, and Jeremy Dworshak.

Absent were: Adam Kramschuster, Lee Filbert, Erik Foltz, Kishor Mehta, David Kusuma, Vikram Barghana, Larry Schmidt (emeritus), and Mal Murthy (emeritus).

This constituted quorum.

Welcome

David welcomed all attendees to the Board meeting. He announced that the next meeting would be on Jan 22, 2016 at Tupperware. Details will be provided after the meeting.

David shared with the Board that he had been having monthly meetings with SPE Headquarters to discuss governance, and with other Divisions to discuss about the changes to the financial sharing program. SPE has increased its share to 12%. David commented that the IMD had been focusing its efforts on ANTEC technical programs and needed to expand more vigorously to TOPCONs, particularly to an IMD branded conference. The IMD could organize outreach activities to champion the Division and to generate revenues that in turn pay for the programs that our members value. The IMD also needed to provide a forum for members to express their suggestions and concerns.

David also welcomed Board members who would be attending the SPE TPO Conference after the Board meeting.

Approval of March 22, 2015 Meeting Minutes

Motion: Hoa moved that the minutes of the March 22, 2015 Board meeting be approved, as written and distributed. Jack seconded and the motion passed.

Financial Report – Jim Wenskus, Treasurer

The financial report covered the period from July 1, 2015 through August 31, 2015. The income report showed a shortage in newsletter sponsorships. On the expense side, spending on the newsletter was lower than budgeted for this period.

The last payment to the SPE Foundation to fund the IMD Scholarship was made in January 2015. The final payment will be made in 2016.

IMD Board of Directors Meeting Continued

Technical Programs – Peter Grelle, Technical Director

ANTEC Program

Antec 2016 will be held in May in Indianapolis, IN. The IMD TPC is Jeremy Dworshak, and the paper review meeting will be held in early January 2016 in Greenville, SC. The review committee comprises of Jeremy (2016 TPC), Srikanth (2017 TPC), Raymond (2015 TPC) and Peter (Technical Director).

TOPCON Programs

The IMD Webinar Series 1 will be held in October-November 2015, and Series 2 is planned for 2017. The schedule for Series 1 is:

- October 29, 2015: Everything You Wanted To Know About Plastics Simulation But Afraid To Ask
- November 4, 2015: Importance of Runner and Gate Designs For Injection Molded Plastics Parts
- November 18, 2015: Injection Molding Design Fundamentals

In 2016, Brad Johnson will be working with Penn State to organize the Injection Molding TOPCON in Erie. The target date is June 22-23, 2016.

Discussions have been ongoing to hold an IMD-sponsored technical session at the SPE Automotive TPO Conference in October 2016. Possible topics include injection molding basics, mold filling analysis and decoupled molding.

Peter reported on the efforts to work with the Mold Making Division (MMD) on a co-sponsored Minitec in Chicago, IL. Additional communications and work are necessary.

David informed the Board that SPE HQ had approached the Detroit section on organizing another China Topcon. Building on the IMD's experience with the first China TOPCON, the IMD could consider being a co-sponsor with the Detroit section.

Communications Report – Rick Puglielli, Chair

Newsletter: The newsletter content is excellent, and articles have been helpful. There was interest from the Board to understand the number of hits for each published newsletter. Content for the Fall newsletter is due on October 13 to give time to include Councilor report after the Council meeting on October 11.

Action: Rick to contact Pedro Matos at SPE HQ on tracking the number of hits for the newsletter.

- **Website:** The simplicity of the website makes it easy to navigate. Discussions were made on using the website to recruit additional sponsorships, with caution to avoid too much commercialism.
- **Social Media:** Rick noted that at this time social media was a tool for individual to network but not a business tool for the IMD. Hoa mentioned that the IMD LinkedIn page was available for the IMD to reach members and potential members.

IMD Board of Directors Meeting Continued

Membership Report – Nick Fountas, Chair

The IMD gained 200 members, of which 30 were from the PRC. Nick noted that there was no change in the membership trend. The IMD brochure, which was redesigned in 2010, had been used as a literature at conferences. We have not been able to gauge accurately the number of responses from this promotion tool.

Since the Board meeting was at the venue for the SPE Automotive TPO Conference, Hoa proposed that copies of the brochure be made available to the conference attendees. David agreed and asked Nick to send an electronic copy of the brochure to be printed and distributed at the conference. David also asked Nick to work with Heidi to refresh the brochure and present it at the next Board meeting.

Action 1: Nick to email David a copy of the IMD brochure, and David will print and make copies available at the 2015 SPE Automotive TPO Conference. (Done as of this report)

Action 2: Nick to work with Heidi to update the design of the IMD brochure, and present it to the Board at the January 2016 meeting.

Nominations – Hoa Pham, Chair

Hoa presented the open positions for Board Officers and the members eligible for nomination to be on the 2016 Board of Directors ballot.

Action: Board members who are interested let Hoa know of intent by 10/20/2015.

HSM and Fellows – Tom Turng, Chair

The due date for 2016 HSM application is October 15, 2015, and for Fellows is October 30, 2015.

The IMD sponsors the application of Dr. Rong-Yeu Chang, CEO of Coretech System Co, for Fellows, and of Jack Dispenza for HSM.

Councilor Report – Susan Montgomery, Councilor

Susan gave an update on governance activities.

Pinnacle Award: Discussions have been on-going about the suggestion to raise the bar for the requirements to achieve this award.

Making SPE global: Although SPE has many activities throughout the world, additional efforts are necessary to be more successful.

Governance Structure: SPE has been keen on applying the principles of Race to Relevance by Harrison Coerver and Mary Byers to streamline the governance body, which included the Executive Committee and Council. At the last Council meeting, a small group was established and had been meeting outside of Council. Susan asked the Board to provide input on this change in the governance structure so that an IMD statement could be formulated and presented at the Council meeting on October 11. Outreach to other divisions had been made to gain more insights into the impending change. The Board strongly supported the model of keeping the Society a technical organization instead of mirroring the SPI.

IMD Board of Directors Meeting Continued

Pinnacle Award Application – David Okonski

The deadline for the 2016 Pinnacle Award application is November 30, 2015. David reviewed the major sections of the application to assist Raymond who will be managing the application this year. Activities of the IMD Board and outreach activities of Board members suit well and meet the requirements of the application.

IMD Board Structure/Progression

The IMD progression structure from TPC to Chair is well defined, and has served well as best practice for the Board. The Committee structure was presented at the last meeting (March 22), and at this meeting, David focused on the Sponsorship Committee.

The Board discussed about the resources needed to continue providing services to our membership. The areas of sponsorship and technical program were emphasized.

In addition to recruiting sponsors for the ANTEC reception, the Board considered introducing banners on our website. David and Rick agreed to work on designing the banner. Hoa proposed to offer a company or companies the opportunity to sponsor the IMD awards, such as the Best Paper Award.

Action: David and Rick to design the website banner for sponsors, and present it to the Board at the January 2016 meeting.

The IMD had been successful in organizing excellent technical programs at ANTEC. The Board discussed about starting a TOPCON or Minitec that the IMD could take ownership of and create its brand around it. Market opportunities, demographics and themes were considered.

Round Table Discussion – All

Brad suggested that the Board look for sponsors for the Best Paper Award. Susan and David offered to contact media organizations to propose this opportunity.

Action: David and Susan to contact media organizations such as Plastics News and update the Board at the January 2016 meeting.

Adjournment

Susan moved that the meeting be adjourned. Tom seconded and the meeting adjourned at 2:00 PM ET.
Respectfully Submitted, Hoa Pham

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Chair-Elect
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Sonoco
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Treasurer
Jim Wenskus
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Secretary
Education Chair
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Srikanth Pilla
Clemson University
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Technical Director
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Past Chair
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University of Wisconsin-Stout
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Councilor, 2014 - 2017
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Lubrizol Advanced Materials
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IMD New Members

The Injection Molding Division welcomes 160 new members…

Kashif Kamran Ahmad
Daniel Alt
Rick Anderson
Jeff Applegate
Eric Ashmore
Mukul R. Atre
Michael Augusta
Steven Bassetti
Gabor Benko
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Ming Fang
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Timothy Frisch
Eric F. Fuentes
Zong Sheng Gao
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Ginu Joseph
Kevin Kipper
Nick Kirby
Gerald Klein
Biren Kothari
Aldo Kremmel
Sokhoang Kruy
Joshua Kryder
Alex Lambert
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Charles S. Layer
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Steve Schake
Jeffrey Stephen Schipper
Paul Laurence Scholl
Scott Schram
Edward Sean Scott
Phoebe Sederstrom
Vahid Shaayegan
Andrew Shipton
Jay Sinnett
Kevin Smith

IMD New Members Continued

Jennifer Browne Snodgrass
Paul S. Sremcich
Yusuke Suenaga
Jacob Donald Sullivan
Chris Sypitkowski
Yanshou Tang
Rachel Taylor
Eder Textli Juarez
Tricia M. Todd
Byron Tolbert
Kathi Katherine Tomaszewski
Eduard Tsvirko
Edward van de Krol
Darin VanDerwalker
Ender Varova
Michael Cory Victor
Raymond E. Wade Jr.
Yanjun Wang
Craig Ward
Robin Waters
Ryan Williamson
Katrin Wolfbauer
Derren Woods
David Worsley
Ke Wu
Tong Wu
Linsheng Xie
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CI Medical Technologies
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Clariant (Australia) Pty. Ltd.
Clemson U.
Coperion (Nanjing) Machinery Co. Ltd.
Covestro
Created Value Consulting
Currier Plastics
DAK Americas LLC
Delphi Automotive
Delta Pacific Products
Deltar Fasteners
Diebold Inc.
Diedre Moire Corp.
Dujiangyan Joiner Machinery Co. Ltd.

IMD New Members Continued

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Eicher Engineering Solutions
Eli Lilly and Co.
Emerald Plastic Magazines Pvt. Ltd.
Engel Machinery North America
Entegris
ES Plastic Products
Escort Radar Detectors
Essmann Hungaria Kft.
EuPC
Ewikon Molding Technologies
FANUC Hungary
Ferris State U.
Firestone Building Products
Five Star Plastics Inc.
Ford - PD - Body Interior - Cockpit and Trim
Ford Motor Co.
Fuda Intelligent Systems
Genova Products
Global Recruiters of Salt Lake City
Grand Rapids Controls
Hayward Industries
Hewlett Packard
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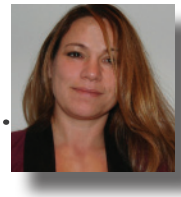


Hello everyone. I hope you enjoyed this 100th issue of Molding Views.

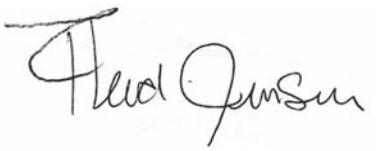
Now that the 2015 year is winding down IMD is gearing up for 2016 and we're seeking all IM industry colleagues to help get the year off to a great start.

It is essential for the IM Division to get industry professionals contribute to the upcoming events for 2016. Currently we are seeking contributions of articles and technical papers and sponsorships for ANTEC 2016. The newsletter is also reaching out to the industry for informative articles and technical papers to share with fellow IMD members. Anyone who may be interested in a column on a specific topic, such as hot runners, tips, maintence would be welcomed.

Sponsorships with the newsletter, events and web site are another great way to show support. These sponsorships help SPE IMD provide industry events and material to enrich SPE members. Reach out to the Injection Molding Division group with your product or services.

I hope everyone enjoys the upcoming holidays. Our next issue will be the Spring 2016 issue. For those who would like to contribute, start sending in your articles!

Thank you all, stay in touch!



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