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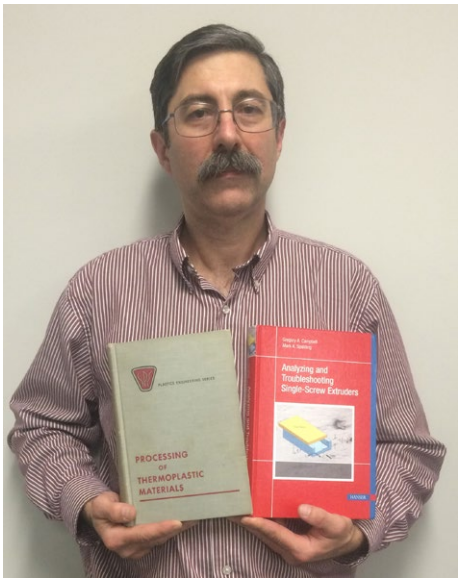
A Message From the Chair



Old and New. We are almost finished with 2015 and on our way to facing 2016. My tenure as your Extrusion Division Chair has already reached the halfway mark and YES, I am having fun!

So what's the big deal about Old and New? I asked that question as I sat down to write this, and happened upon the two books pictured in my hands. The one on the left is the classic *Processing of Thermoplastic Materials*, edited by Dr. Ernest Bernhardt, while the book on the right is the soon to be classic *Analyzing and Troubleshooting Single-Screw Extruders* by Dr. Gregory Campbell and Dr. Mark Spalding. One Old, one New. One published two years ago; one published when I was two months' old.

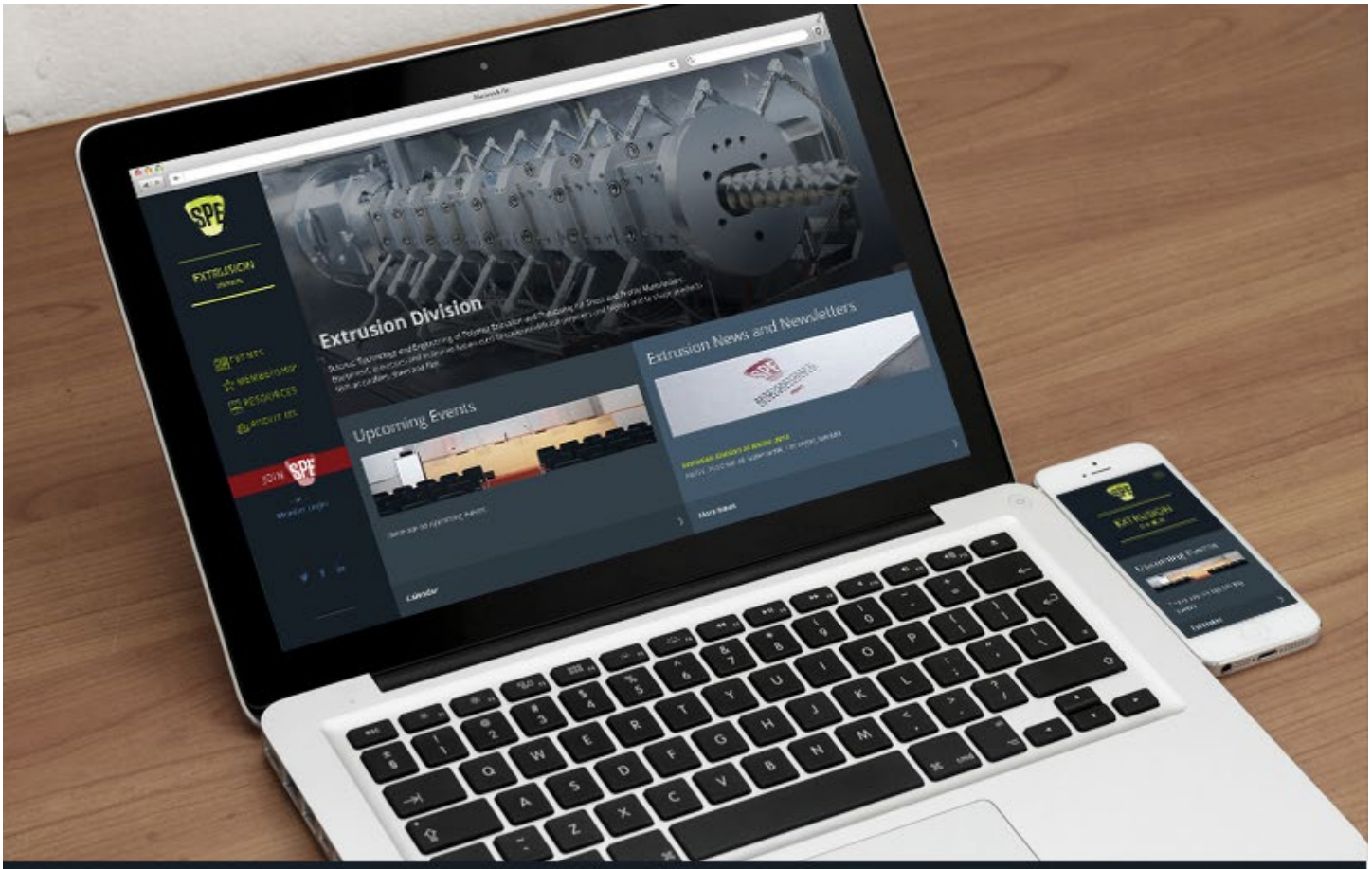
Old and New, but a lot in common. Times change, but for the plastics processor some things are timeless: Making sense of what is happening in extruders; learning how to extrude more effectively; needing to troubleshoot the process. The authors themselves have much in common—members of SPE , and I am proud to say, all members of your Extrusion Division. Mark and Greg are still serving while Dr. Bernhardt served before my time.

The Board of Directors of your Extrusion Division has been working hard to make one of SPE's oldest divisions new again, and this will become apparent to our membership in the coming months. Previous newsletters have talked about our Young Professionals initiative. Our inaugural members certainly have brought energy and enthusiasm to the Board, which we will be building upon as we recruit more YPs this year. Look for our division logo to get a refresh and keep an eye on our division website and the Extrusion Wiki. Everything we are doing is for you, the membership of our Extrusion Division, so we want it to be relevant for YOU!

The New Year will bring us to another ANTEC; this one in Indianapolis. Your Extrusion Division will have an engaging technical program, combining the Old and New into several days of presentations. Look for the Old in such things as the tutorial sessions. On the New side of the ledger, we will have a session on Pharmaceutical and Hot Melt Extrusion. Best thing about ANTEC is renewing Old acquaintances and making New contacts. At ANTEC, please make time to introduce yourself to me and the other members of your Board. We want to hear what New things you would like to see your division and your Society do for you.

David Anzini

SPE Extrusion Division Chair, 2015-2016



Check Out the New SPE Extrusion Division Website

extrusion.4spe.org

Remembering ANTEC 2015

The months have flown by quickly since ANTEC 2015, which was held in late March concurrent with NPE. Here is the list of the SPE Extrusion Division award-winners that are presented at every ANTEC during the Division's evening reception:

Distinguished Achievement Award: This award is sponsored by The Extrusion Division to honor individuals who have made significant contributions to the development and advancement in the extrusion industry as a whole.

The award this year was presented to **Timothy Womer** of TWWomer and Associates. Womer has been SPE President (2006-2007), Extrusion Division Chairman (1999-2000), and has been involved in numerous other SPE Committees. In 2012 Tim was elected to the Plastics Hall of Fame. He is a frequent author at ANTEC and other conferences, and is an SPE Fellow, SPE Honored Service Member, and was the past recipient of the Bruce Maddock Award.

Bruce Maddock Award: Award recipients have contributed significantly to the advancement of single-screw extrusion technology or associated processing technology by providing experimental achievements and understanding to the fundamentals of the process. The award recipient is selected by The Extrusion Division Board of Directors and is sponsored by The Dow Chemical Company.

The award this year was presented to **Dr. Ernest Bernhardt**, who was one of the DuPont Dream Team Extrusion Researchers in the 1950s. One of his major contributions was the assembly (editor) of the book Processing of Thermoplastic Materials. This was one of the first quality books to publish on the subject (1958). He was a pioneer and innovator of processing for single-screw extruders including vacuum extraction, valved extrusion, and instrumentation. He is an SPE fellow and a member of the Plastics Hall of Fame.

Heinz Herrmann Award: Award recipients are to have contributed significantly to the advancement of twin-screw extrusion technology. This can be accomplished through experimental or theoretical achievements that provide an understanding to the fundamentals of processing material in the extruder. These experiments could include (but not limited to) work relating to solids conveying, melting, mixing, devolatilization, and pumping functions of twin screw extrusion (TSE). The Heinz Herrmann Award is sponsored by Coperion Corporation.

The award this year was presented to **Daniel Tynan**, another of the DuPont Dream Team Extrusion Researchers in the 1950s. He has patents on polymer finishing using novel thin-film melt reactors, one of which was a counter rotating twin-screw device. He is a co-inventor of a key DuPont patent on a process for nylon toughening involving staging the feed to a twin-screw extruder. Some of his important contributions to DuPont that were not published include: fundamentals/modeling of TSE, TSE experimental validation and new screw designs.

Heinz List Award: Recipients are to have contributed significantly to the advancement of polymer devolatilization, drying, evaporation, or reactive polymerization technologies pertaining to extrusion processing. The Heinz List Award is sponsored by List USA Inc.

This year's award was presented to **Dr. Costas Tzoganakis**, University of Waterloo, Chemical Engineering. Dr. Tzoganakis was honored for his innovative research in reactive extrusion technologies. These technologies include numerous reactive systems using screw extruders including modification of LLDPE using peroxides, PP modification using peroxides, nitroxides, and sulfonyl azide chemistries.

Jack Barney Award: The Jack Barney Award was initiated by Welex Corporation to honor Jack Barney, the founder of Extrusion Dies Industries. The award is to be presented to persons who have made a significant contribution to the development of the flat sheet industry. Their contributions can be technical or commercial, but should have value to the industry as a whole. The Jack Barney Award is sponsored by Extrusion Dies Industries.

This year's recipient was **Doug Darrow**, president of Allied Dies. Doug is well known innovator and he has been instrumental in sheet for 40+ years. He innovated at Brown Machine, Davis Standard, Gloucester, EDI, Cloeren, and now his own company. Allied dies designs and manufactures custom dies, as well as related tooling, for plastic to foreign and domestic processors of: slot die coating, extrusion coating and laminating, cast film and sheet for industrial markets, aircraft, appliances, automotive, electronics, and housing.

2014 ANTEC Best Paper Award: A Mechanism for Solid Bed Breakup in Single-Screw Extruders–Solid Bed Shape Change, co-authored by Dr. Gregory A. Campbell, Castle Research, Jonesport, ME; and Dr. Mark A. Spalding, The Dow Chemical Company, Midland, Mich.

Outstanding Service Award: This was given to Karen Xiao in recognition of her service as Extrusion Division Board Chair 2014-2015 and Technical Program Chair 2013-2014.

New SPE Honored Service Members: During the awards ceremony, the Extrusion Division also announced that long-time Extrusion Board members **John Wagner** (left) of Crescent Associates and **Dr. Paul Andersen** of Coperion Corp. were named SPE Honored Service Members.

Shape Extrusion Topcon

Sponsored by the SPE Extrusion Division, and SPE Milwaukee/Chicago Sections

March 29-31, 2016, Holiday Inn Convention Center, Gurnee, Ill.

Mark your calendars! Don't miss the SPE Shape Extrusion Topcon….the event where you'll learn the theory and tricks of the trade to make high-precision extruded products. A preliminary agenda follows:

- Single screw extrusion
- Twin screw extrusion
- Screw design
- Process troubleshooting
- Computer modeling of the extrusion process
- Die design
- Upstream material handling & feeding
- On-line gauging
- Control developments and integration/tuning
- Co-extrusion
- Compounding
- Downstream tracks: film, sheet, tubing and profile
- Process tutorial and troubleshooting sessions

Speakers will include members of the SPE Extrusion Division Board, industry experts and academia. Click here for the latest program details.

Questions? Contact the Program Chairman, Dr. David Bigio, Univ. MD via e-mail: dbigio@umd.edu

Registration/fees:

Early registration before March 1, 2016:

- $525 Full Conference non-member (includes SPE membership)
- $425 Full conference member

After March 1:

• $575 Full Conference non-member (includes SPE membership)

• $475 Full conference member

Optional tutorial sessions: add $100 or $200 stand alone

Registrations will be accepted after December 1.

Tabletops/corporate sponsorships: A limited number of sponsorships are available for only $1000, if interested contact Charlie Martin of Leistritz via e-mail: cmartin@leistritz-extrusion.com

We look forward to seeing you at this high-tech event!

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Ben Dryer & Ali Goger: 2015 Recipients of the Lew Erwin Scholarship

Ben Dryer, a MS candidate at University of Maryland, and Ali Goger, a PhD candidate at McMaster University, were announced as the 2015 recipients of the Lew Erwin Scholarship by the SPE Extrusion Division.

Ben has studied mechanical engineering both as an undergraduate and graduate student. During his graduate program, Ben's research has focused on twin-screw compounding with a greater emphasis toward mixing. One tool used in this work to evaluate mixing efficiency is Residence Stress Distribution (RSD). Ben notes, "When compared with residence time distribution the RSD presents a picture of stress history developed in the extruder mixing section." Ben co-authored an ANTEC 2015 paper title Combinatorial Effects of Kneading Elements on Mixing in Twin-screw Compounding. For the work reported he used the RSD methodology to quantify the stress developed by different combinations and lengths of kneading blocks in a twin-screw mixing section. His current research goal is to connect RSD to the resultant material properties of an extruded final product.

Ali is a graduate Chemical Engineer currently working on his PH.D thesis, Solvent Free Extrusion Emulsification. His project relates to an unconventional use of co-rotating twin-screw extruders to produce solvent-free oil in water emulsions for latex, printing, and cosmetics industry. During the course of his work on the twin-screw he has evaluated the effect of chemistry, processing conditions and screw configuration. Ali has also been actively involved in the SPE Ontario student chapter where he has served as VP since 2013.

This award honors Lew Erwin's commitment to the importance of education for the future success of the Polymer Industry. Lew Erwin's major technical contribution to the Extrusion area has been in seminal works in the concepts of laminar mixing in extrusion. His ideas of extensional mixing and reorientation were presented with a simplicity that demonstrated the importance of the ideas and ways to apply them to extrusion. His work received 2 Best Paper Awards.

Erwin's contribution in the field of polymer processing went beyond the area of extrusion. He was instrumental to the growth of the Polymer Processing Program at MIT in the late 70s and 80s. He worked to create the swirl pattern in Irish Spring. He helped solve the problem of having the heat shield elements stick to the NASA shuttle.

His commitment was to the area of education. He empowered undergraduates, Masters and Ph.D. students. Many of his early papers were co-authored with undergraduate students. He participated on the Extrusion board and was chair of the division in 1983.

Removing, Cleaning, Restaging and Reinstalling Your Twin-Screw Extruder Screw Set

Advice for removing screw elements from shafts:

By Bert Elliott and Bill Novak, Leistritz

If at all possible, work on the screws immediately after use while they are still hot, or put the screw shaft assembly back in the ZSE twin screw extruder to heat the shafts and elements together. Allowing the elements time to heat up slowly (about 20 minutes) is always better. The idea would then be to remove the screw tips and slide off a portion of the screws onto a raised table or cart right at the end of the machine.

If the shafts must be removed from the machine and heated with a torch, please use caution and heat evenly all the way around the element. Do not let the elements change color! This can affect the metallurgy. Warm them instead of burning them. Use a rosebud acetylene torch and be patient. While the elements are hot, use a punch made from wood or hard plastic to push the elements from the shaft. An aluminum or brass drift pin can also be used but caution is always advisable when impacting the elements. An electric impact hammer may be purchased that will significantly help.

Follow these steps:

- USE HOT GLOVES
- Support the screw shaft assemblies at enough points so that they do not bend
- Unscrew the tips to remove the elements
- While using the rosebud pull the element from the shaft
- More difficult elements may need friendly persuasion
- Angle the appropriate punch against the flight of the element
- Use a rubber mallet and hammer while heating until the element moves
- Remove one at a time and be sure brush clean or scrape the exposed shaft

An impact hammer is a noisy device, and works very well at breaking loose stuck screw elements. The above steps still need to be followed for screw removal, but additionally:

- Wear hearing protection!
- Modify the device to accept a brass tip
- While heating, apply hammering action to the flight of the element

Screw element cleaning and inspection:

Best results may be obtained by at least doing an initial cleaning with a steel wire brush or copper gauze as the screws are removed from the machine. Once they are brushed off, the elements may be placed in an oven or fluidized bath to clean them. Don't exceed the temperature rating of the metallurgy!

If there is black, baked-on, degraded material, some form of mechanical abrasion will be required to remove it. Brass or copper brushes are often too soft, and won't get baked on degraded materials off. If this is the case:

- WEAR GLOVES AND EYE PROTECTION
- Use a stiff steel wire brush wheel on a bench grinder
- Use a belt sander (small air-powered portable belt sanders work well)
- Use a sandblaster or dry-ice blaster
- Clean element key ways and splined bores

Once the elements are clean, inspect them for hairline cracks, and any nicks or gouges. Nicks and gouges may become cracks and should be gently smoothed out with a file or grinding disc.

In addition, end faces should be "stoned" or sanded smooth with 320 grit sandpaper. This should be done on a level flat mechanical surface such as a marble slab or thick steel plate. Lay emery cloth or 320 grit paper flat on the surface and work the face of the element in a figure eight pattern applying only enough pressure to evenly clean the element face. If wear rate is to be documented, the dimensions should be checked with a micrometer and recorded. Elements with hairline cracks should be discarded. Damaged elements break apart while running and have been known to twist shafts, wreck barrels, and cause catastrophic failure to gearboxes.

Click here to read the full article.

Nicholas Moore: 2015 Recipient of the Extrusion Division's Ed Steward Scholarship

Nicholas Moore, an incoming freshman at Pennsylvania College of Technology, Williamsport, Pa., was announced as the 2015 recipient of the Ed Steward Scholarship by the SPE Extrusion Division.

This award honors Ed Stewards' commitment to the importance of education for the future success of the Polymer Industry. The award is for a student enrolled or entering a technical program leading to an associates or bachelor's degree who is committed to becoming a "hands-on" worker in the plastics industry. It is supported by American Kuhne, the company Ed co-founded with Bill Kramer.

Ed Steward was a co-founder of American Kuhne, Inc., in Ashaway, RI in 1997 where he was the Vice President of Process Technology. Prior to that, he was employed at the Davis Standard Corporation for 24 years as the chief process consultant. His responsibilities included screw design and application along with processing related tasks that insured extrusion systems met the designated performance goals. He is widely known as the developer of the Steward Barrier Screw, which greatly contributed to the success of American Kuhne.

He had a Bachelor of Science degree in Mechanical Engineering from the University of Connecticut. Ed was a highly respected Fellow of SPE and wrote numerous papers for various extrusion societies and publications on screw design and related topics, including co-authoring the extrusion chapter in SPI's Plastics Engineering Handbook. He posthumously received the SPE Extrusion Division's Distinguished Achievement Award in 2014.

The Division established the Ed Steward Scholarship in his memory in 2014.

WWU SPE Student Chapter Takes a Five-Company Tour

The Western Washington University SPE Student Chapter took a trip to Portland, Ore. from Bellingham, Wash. (where the university is located) on October 15-16 to tour five different companies related to plastics engineering. The 44 students and eight professors that participated saw how an injection mold manufacturing business functions at Bestco, followed by a tour of a custom injection molder, R&D Plastics.

At ChemWest, the group learned about high-precision plastics machining. Next up was Nike In House Manufacturing, where the air soles for Nike shoes are manufactured. Students learned about how the process engineers there have to constantly balance trying to improve the manufacturing processes, while still meeting the extremely high production volume demands.

The final tour was of Daimler Trucks North America's research facilities. Highlights included their wind tunnel, vehicle shaker lab, material testing lab, and thermal test chambers.

Many engineering students at WWU are currently working on projects with the companies that were toured, including custom compounding with extrusion equipment. The tours helped give context to their work. Some tour participants were freshmen, eager to learn more about engineering as a whole. In general, seeing the concepts and processes that you are learning about in classes being implemented in the real world is a great enhancement to learning.

Calibrate Those Instruments

By Timothy Womer

I was recently asked to visit a sheet processor to determine the cause of a major screw design problem. So, as always, I started at the beginning to gather all of the technical information to determine the root cause. This facility had five large extrusion sheet lines, and they were issues with all five extruders.

With the extruder at room temperature, I set up three dial indicators on the discharge flange of the barrel in the X,Y and Z axis. Then I turned on the barrel heaters to the standard zone setting to make sure that the barrel thermally expanded in the Z-axis direct as much as it should theoretically, and that the X and Y indicators move minimally.

The simple equation to determine the amount of expansion that a barrel should grow is:

$\Delta L = 0.00000633 \times \Delta T \times L$, where:

ΔL = The change in length

ΔT = The change in temperature, in this case from room temperature to the barrel zone setting

L = The heated length of the barrel

Amazingly the barrel grew within about 0.030-in. of the theoretical change in length, which in this case was approximately 0.750 in.

Then I measured the flight OD on several of the screws for various designs to determine if there was a consistent wear pattern. There was, so that was noted.

Then I gathered all of the process data. This is a very important part of doing a “CSI” on screws. This is where you collect the given throughput rate at a given screw speed against the head pressure during that timed rate check, motor load and melt temperature.

The motor load reading is taken from the ammeter on the control panel; the screw speed is taken from the tachometer. If at all possible, it is best to have the customer’s plant manager to check the motor load with a hand held meter to verify that the ammeter on the control panel is reading correctly. As for checking the screw speed, this typically can be done by using a stop watch and counting the rotation of the drive quill at the back of the gearbox.

In this case the control panel ammeter was reading correctly, but the screw speed was not. The customer’s setup sheet showed that their standard setup was to have the extruder operating at 70 rpm, but when I counted the revolutions of the drive quill, I was getting 92 rpm. This is an error of 24%.

I then checked the tachometer on the line next to the one that I was gathering the process data from and the tachometer on it read 86 rpm but when I did the count, it was only rotating at 70 rpm. This meter was mis-calibrated by 23%.

So, the moral of the story is, the only thing worse than no data is BAD data. In this case, the customer immediately had their maintenance people re-calibrate all of their control instruments.

NOTE: Sometimes the screw rotation is faster than what a person is able to visually observe. In these cases, I take the advice given to me when I was a kid by an old mechanic mentor of mine (who only had a 4th grade education)...I "count the clicks." I had no idea what he meant until he showed me.

Howard took this machinist scale (a pencil or pen will work) and turned on the chuck of the engine lathe in his shop, then took the scale and let it rub against the chuck. On an extruder it can be a small bolt in the back of the rotating drive quill or the drive key on the shank of the screw. Then with your stopwatch in one hand the "clicker" in the other, you can count the number of times that bolt or key hits the end of the scale, pencil or pen...or the number of clicks. "Count the clicks." Very simple but very effective.

Just make sure that your instruments are calibrated on a regular basis and also do a check and balance when gathering data. Never trust what you think you see the first time.

Tim Womer is a recognized authority in plastics processing and machinery with a career spanning more than 35 years. He has designed thousands of screws for all types of single-screw plasticating. He now runs his own consulting company, TWWomer & Associates LLC. Contact: (724) 355-3311; tim@twwomer.com twwomer.com

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The Source of New Plastics Leaders!

"As a student member of SPE, I've been given many opportunities to network and learn about the industry primarily through conferences and events. My first conference was ANTEC® in May 2014 and it was an eye opening experience that I will never forget. Next Generation put together a Plastics Race that enabled participants to explore the city of Las Vegas, network with everyone there, as well as learn new things about plastics. There were riddles to be answered and the top four teams won prizes such as an iPad for the team that came in first, iPod touch for second, iPod nano for third, and iPod Shuffles for the team that came in fourth. Next Generation did an amazing job encouraging the participants to do their best, have fun, and I know that they'll make Orlando an even better experience in 2015!

I encourage everyone to attend every conference they can. I especially encourage students to attend because they are the future of the industry and learning what companies are doing now will help to understand what you can do to change the industry for the better."

Julia Gilchrist, SPE Student Member
Pennsylvania College of Technology

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SPE Extrusion Board Supports IPIC Twin-Screw Seminar and Workshop in Columbia

SPE Extrusion Board Members (left to right) Dr. Costas Gogas, Dr. María del Pilar Noriega Escobar, and Charlie Martin of Leistritz presented in June at the IPIC Twin-Screw Seminar and Workshop in Columbia.


HAPPY HOLIDAYS!
From
SPE Extrusion Division

TECH TIPS

Melting 101

Surprising as it might seem, plastics processors generally don't understand how polymer melts in a single-screw extruder. Even those with a great deal of practical experience have problems grasping the concept, and it's an important one to understand to maximize the efficiencies of your extrusion operation.

To simplify the concept and illustrate the basic mechanism, think of the barrel rotating around a stationary screw. Most single-screw analysis is based on this technique, and I've found that it simplifies the geometry and provides the same results.

The polymer enters the screw as particles (pellets, powder, flakes) and is compacted by the screw flights into a tightly compacted mass (see A in the accompanying illustration). At that point, friction between the pellets and the barrel raises the temperature of the polymer closest to the barrel wall. In addition, some heat is conducted into the polymer from the hot barrel, helping to form a thin film of melt between the barrel and solid polymer (see B in the accompanying illustration).

From that point forward the energy for melting is developed in the film largely through viscous dissipation or shear heating. Most processors understand the concept of transferred heat from the hot barrel, but viscous dissipation is not as easily grasped, which is unfortunate, since it supplies almost all the energy for polymer melting. What happens as a result is a misguided reliance on barrel temperatures for melting.

Click here to read the article in its entirety.

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