



EXTRUSION

SPE EXTRUSION NEWSLETTER | SUMMER 2018

CHAIRMAN'S MESSAGE

“Make Extrusion Great Again” were the words I used to embrace the challenges ahead for SPE and the Extrusion Division. We live in a world where new technologies are enabled through new materials (3D printing is just one example). I find it ironic that such high-tech stuff relies on 50-year-old extrusion technology, which has not changed fundamentally over these past decades. We need to find new ways to make working in extrusion as attractive and interesting as A.I.

ANTEC is just behind us and we are already starting to coordinate activities for the next ANTEC, March 18-21 in Detroit. SPE is reinventing ANTEC, the new model is designed to provide better value to its membership with one or two days added to the program for ‘megatrend’ sessions. The paper submission deadline is October 19 which presents an additional set of challenges for the Extrusion Division to prepare an exciting and informative technical program with two months less time than usual. The Technical Marketing sessions at the Orlando meeting received a large number of presentations, perhaps this is an indication of the future direction for ANTEC.

The ultimate success of SPE and the Extrusion Division depends on its membership. We invite you to reach out to us on social media (e.g. LinkedIn) and let us know what you need and/or want to see in terms of programming, events, etc. Last month we organized two MiniTec conferences in Detroit and Atlanta; please let us know if you want to see more of this or something completely different. We need to hear from you to service your needs better.

I would like to take this opportunity to welcome our new Board members as well as acknowledge the support from our Young Professionals.

Lastly, I would like to thank our Extrusion Division sponsors and to formally apologize where we were not able to promote your products and services at our Wine & Cheese Reception during the recent ANTEC. When ANTEC is co-located with NPE, the limited number of meeting rooms allocated for ANTEC precludes us from having separate rooms for the Awards Ceremony and Reception. The reception was held in the foyer outside of the meeting rooms where there was no possibility to run the slideshow where we acknowledge our sponsors. We are working to resolve this going forward and want to thank you in advance for your understanding and continued support.

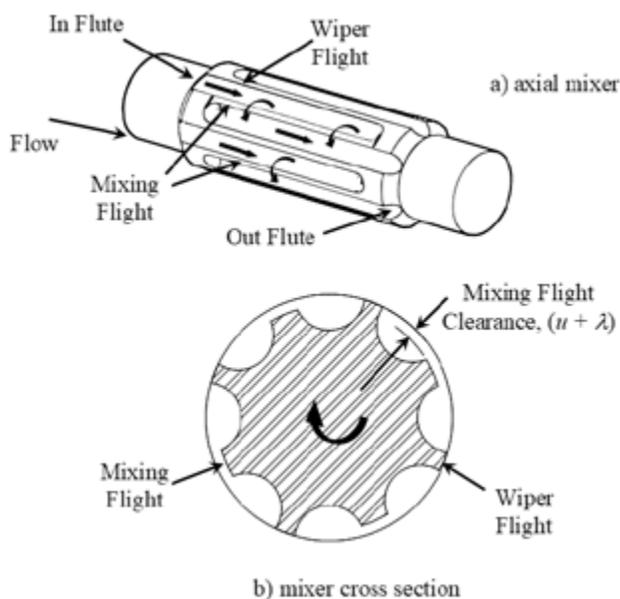
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SPE Extrusion Division Chair 2018-2019
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ANTEC BEST PAPER 2017: DESIGN OPTIMIZATION FOR MADDOCK MIXERS FOR SINGLE-SCREW EXTRUSION USING NUMERICAL SIMULATION

Authors: Xiaofei Sun, and Mark A. Spalding, The Dow Chemical Company, Midland, Mich.; Timothy W. Womer, TWWomer and Associates LLC, Edinburg, Pa; and Ned Uzelac, Performance Feed Screw Inc., Mississauga, Ontario, Canada

The Maddock mixing section is the most widely used mixing element used in extrusion today. There are many variables. Understanding its' functions will provide insight into any extrusion mixing applications. See below for a schematic of this device:

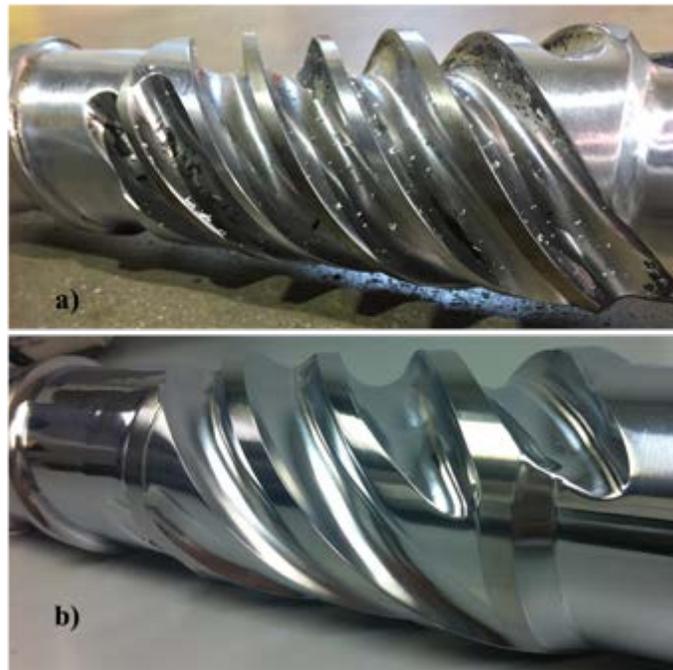


End view Maddock mixing element

Abstract: Maddock-style mixers are used extensively on single-screw extruder screws to disperse materials into the molten resin matrix. Since the time LeRoy invented the device and Maddock perfected and commercialized it, the

device has undergone several innovations. The goal of this paper is to describe the optimal flute geometry and mixing undercut dimension for a Maddock mixer with the goal of mitigating degradation gels and maximizing dispersive mixing efficiency.

Examples of Maddock mixers:



a. Poorly designed mixer – flutes are too deep causing long residence times and resin degradation

b. Well designed mixer – flute depth is half the width of the flute (short residence times and no resin degradation)

To download the paper in its entirety [CLICK HERE](#) ■

SPE EXTRUSION DIVISION HOSTS 2 MINITECS IN JUNE 2018 - 120+ ATTEND

Minitecs are designed to be low cost, highly technical events that bring extrusion technology to local markets. The SPE Extrusion Division hosted two in June 2018:

Minitec #1 was held June 14, 2018 at the Institute for Advanced Composites Manufacturing Innovation (IACMI) in Detroit, MI. The event, sponsored jointly with Michigan State University, featured single and twin screw technical presentations followed by a tour of the IACMI facility and a reception.



Detroit Minitec audience



Tour of the IACMI facility before the reception

Minitec #2 was held June 21, 2018 in Marietta, GA. A highlight was a keynote presentation by Dr. John Muzzy, Professor Emeritus at Georgia Tech. A few rounds of golf were also enjoyed at the adjacent Championship golf course.



John Christiano, Davis-Standard, addresses GA Minitec crowd



SPE Extrusion Division Board members at the GA Minitec

The SPE Extrusion Division would like to thank Sue Wojnicki and Scott Owens of SPE National for their great work. Also Laraine Owens of IACMI and Ramani Narayan of Michigan State University. We'd also like to thank the Minitec speakers and sponsors for their efforts and generosity that makes these events affordable and possible:

- BARR
- AEC/Sterling
- Davis-Standard
- Gneuss
- Leistritz Extrusion
- Motan
- Witte Pumps
- Brabender
- Compuplast
- SchenckAccurate
- Teel Plastics
- Maag
- Plastics Technology Magazine ■

EXTRUSION INNOVATORS HONORED AT ANTEC 2018

At each ANTEC the Extrusion Division honors individuals for their contributions to the industry in various categories, and to SPE. This year's awardees:

- **Distinguished Achievement Award:** 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, this award was given to **Mark D. Wetzel**, a retired SPE fellow who at DuPont developed fundamental understandings of the complex industrial processes that were used to improve the process efficiencies in order to enhance the profit of the company.
- **Bruce Maddock Award:** Sponsored by Dow and given to individuals who have contributed significantly to the advancement of single-screw extrusion technology or associated processing technology. In his 33-year career at DuPont (and now Dow), this year's recipient, **Dr. Barry Morris**, has conducted a number of fundamental studies exploring the effect of film and coating processes (downstream of the extruder) and product performance.
- **Heinz Herrmann Award:** Sponsored by Coperion Corp., award recipients are to have contributed significantly to the advancement of twin-screw extrusion technology. This year's recipient was **Dr. Costas Tzoganakis**. He has researched numerous reactive systems using twin-screw extruders. His most recent application is devulcanizing and further in line processing of tire tread stock.
- **Heinz List Award:** Sponsored by List USA Inc., recipients are to have contributed significantly to the advancement of polymer devolatilization, drying, evaporation, or reactive polymerization technologies pertaining to extrusion processing. At ANTEC 2018, this award was presented to **Dr. Joseph Golba** of PolyOne. Dr. Golba has 39 Years of industrial R&D and technology experience and leadership in many areas including polymer blends and twin-screw extrusion and reactive extrusion. While at PolyOne, he developed and optimized a reactive extrusion-based processes for chain extended nano-nylons.
- **Jack Barney Award:** Sponsored by Extrusion Division, the award is given to individuals who have made a significant contribution to the development of the flat sheet industry. This year's recipient, **Eddy Hilbrink**, is world-known as the lead developer for nanolayer stretch film, a development that in 2011 won the DuPont packaging award for innovation. ■

SPE MOURNS LOSS OF DR. COSTEL D. DENSON: 1934-2018



Dr. Costel D. Denson, a longtime SPE member who was active in the Extrusion Division and was a frequent presenter at ANTEC, died April 23 at the age of 83. Dr. Denson joined the University of Delaware in 1977 as an expert in polymer engineering and fluid mechanics. During his long tenure there, he served as interim dean of the College of Engineering and later as vice provost for research in 1994. He remained in that position until 2000 when he returned to his faculty position. His research included foaming, rheology, and polycondensation reactions. Following retirement from the University of Delaware in 2005, he was appointed as a scientific advisor to the U.S. Department of Defense and the U.S. Environmental Protection Agency.

Dr. Denson was Extrusion Division Chairman in 1986 and received the division's best paper award in 1987 and 1989. He was named an SPE Fellow in 1986. ■

EXTRUSION FORMULA OF THE MONTH: WHILE THERE'S LOTS OF DATA THAT INFLUENCES SCREW DESIGN, PROCESSORS USUALLY DON'T HAVE ACCESS TO IT

So instead, try calculating drag flow to see if your screw is working properly.

By Jim Frankland

How do you know if your screws are working properly? One of the most useful evaluations is the relatively simple calculation of drag flow. Drag flow is simply half the volume of one turn of the metering section per second at a specific screw rpm, which, when multiplied by a units conversion and the melt specific gravity of the polymer, is a very accurate approximation of the output in lb/hr at no head pressure.

The calculation was developed and verified in the early 1950s, primarily by researchers at Western Electric, as follows:

$$1/2 \pi^2 D^2HN(\sin\Theta)(\cos\Theta) = \text{in.}^3/\text{sec}$$

You can make a little more accurate by adding a shape factor, which represents the width-to-depth ratio of the screw channel. The shape factor compensates for the edge effects of the flights and the channel shape. For most screws, a shape factor for the metering section of 0.95 works well. So:

$$0.95 (0.5) \pi^2 D^2HN(\sin\Theta)(\cos\Theta) = \text{in.}^3/\text{sec}$$

Further, a large percentage of extrusion screws use a standard pitch (flight pitch equals screw diameter) in the metering section, as it represents the best combination of overall performance in most cases. This simplifies the term $(\sin\Theta)(\cos\Theta)$ to 0.289.

Additionally, (π^2) can be simplified to 9.87 and N is in revolutions/ sec so by adding 1/60 the screw rpm can be substituted directly:

$$(0.95) (0.5) (9.87) (0.289)(1/60) D^2HN = \text{in.}^3/\text{sec}$$

$$0.02258 (D^2HN) = \text{in.}^3/\text{sec}$$

Where

D = Screw diameter
H = Channel depth
N = Screw rpm

To read the entire article, as written by Jim Frankland in the June 2018 issue of *Plastics Technology*, [CLICK HERE](#) ■

EXTRUSION PRESENTATION OF THE MONTH: PROFILE-TUBE EX- TRUSION DIE DESIGN WITH FLOW SIMULATION

Presented by Steve Schick, Teel Plastics, at June 21, 2108 SPE Extrusion Division Minitec

Extrusion tooling for both profile and tube/pipe designs have evolved from split/insert dies to more complex designs incorporating EDM (both carbon and wire) and CNC. The design freedom gained from the use of this technology has allowed for the reduction of parts (SKUs) required to make a profile functional as well as the increase in co-extrusion dies to support a products form, fit and function.

The implementation of this mfg./design platform the tooling costs have increased, however the development costs for tuning in a die consume a greater percentage of the overall costs.

The use of a flow analysis tool during the design phase can reduce the cost, timing and support the communications on the project development both internally and externally for an extrusion processor.

To download this presentation [CLICK HERE](#) ■

BOOK RECOMMENDATION: DIAGNOSTICS OF EXTRUSION PROCESSES, NATTI S. RAO

The widespread use of large scale units for manufacturing blown film, blow-molded articles, flat film, and extruded pipes necessitates troubleshooting on site. This book provides practical computational tools which can be applied easily on the shop floor to obtain quick solutions in these and many other areas of polymer extrusion.

To order this book [CLICK HERE](#) ■

SPE WEBSITE LINK OF THE MONTH

Plastics Research Online allows you to view and download technical articles for free. Browse the latest articles by category including: Applied Rheology, Bioplastics, Composites, Conductive Polymers, Engineering Properties, Extrusion, Failure Analysis, Injection Molding, Plastics Nanotechnology, Polymer Modifiers, and Thermoplastics.

To access these article [CLICK HERE](#). ■

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EXTRUSION

SPE Upcoming Calendar of Events:
[CLICK HERE](#) for all upcoming SPE events.

For the latest on the SPE Extrusion Division
and for contact information [CLICK HERE](#).

Newsletter Editor:

Jim Callari, Plastics Technology Magazine