

"MAKING PROPERTIES AND PROFITS"

Twin-Screw Compounding Workshop

October 6-8, 2009

Workshop Leader: Adam Dreiblatt

Polymers Center of Excellence

Charlotte, NC

Program Overview

This three-day workshop focuses on the application of intermeshing co-rotating extruders in compounding applications. Training is directed towards machine operators, process engineers and supervisors as well as product development scientists in both research and manufacturing environments. *Participants are reminded that the goal of compounding is to produce properties, not pellets.* The goal of this workshop is to explain *how* twin-screw extruders create properties.

Interactions between screw design, raw materials and process parameters are presented in such a way that both experienced users and novices will benefit. Common unit operations are explained in practical terms with no prior knowledge or experience required. Upon completion of the training, participants will return to the workplace armed with techniques to improve quality, production rate and yield.

Participants will conduct hands-on compounding experiments using a Theysohn TSK 20 with split-barrel capability. The hands-on portion of this workshop is designed to be an interactive experience rather than a demonstration for spectators. Workshop participants will be introduced to experimental design as a method to identify optimum compounding conditions.

Adam Dreiblatt

Adam has been involved with the practical aspects of twin-screw extrusion for over 25 years. He was formerly Manager of Process Development at Werner & Pfleiderer Corporation and Director of Manufacturing for the Novon Products Division of Warner-Lambert. Adam is now Director of Process Technology for Century Extrusion, a leading supplier of twin-screw compounding extruders and replacement components.

Adam has authored and presented numerous technical papers as well as published articles on various aspects of twin-screw extrusion. He has contributed several chapters in reference books including: "*Screw Design*," Encyclopedia of Polymer Science and Engineering (John Wiley), "*Intermeshing Co-rotating Twin Screw Extruders*," Mixing in Polymer Processing (Marcel Dekker), "*Internal Mixers, Single and Twin Screw Extruders*," Handbook of Process Plant Machinery (Butterworth Publishing). Adam holds a M.S. in Applied Science from New York University.

Polymers Center of Excellence

The Polymers Center of Excellence (PCE) provides the technical and training needs of the plastics industry through polymer processing, physical testing, educational products and consulting. PCE has evolved from the Industrial Extension Service at North Carolina State University and the North Carolina Polymers Extension Program into a full-service product and process development organization with ISO 9001 certification.

The workshop will highlight PCE's compound development capabilities utilizing the Theysohn TSK 20 twin-screw compounding line and related support equipment. Complete physical testing, extrusion, injection molding, blow molding and vacuum forming resources are also available at PCE.

Workshop Program

Tuesday, October 6, 2009, 8:30 a.m. - 4:30 p.m.

Twin-Screw Extruder Design

- Introduce concepts responsible for creating properties on co-rotating twin screw extruders
 - Degree-of-fill, shear rate, residence time/residence time distribution, heat transfer
 - Dispersive vs. distributive mixing
- Influence of extruder configuration on compounding performance
 - How machine design impacts mixing (e.g. d_o/d_i , co versus counter rotation, etc.)
 - What is optimum extruder configuration?

Process Design

- Description of unit operations: feeding, melting, mixing, venting, pressurization
- Introduction of the process model – role of specific energy
- Interaction of process parameters
- Process optimization

Wednesday, October 7, 2009, 8:30 a.m. - 4:30 p.m.

The “Art” of Screw Design

- Functional description of the working principles for each element type (conveying, mixing)
- Overview of available screw element designs
- Characterization of dispersive and distributive mixing elements
- Selection of the optimum screw type for each of the unit operations
- Examination and analysis of typical compounding screw configurations
 - Masterbatch, concentrates
 - Non-reinforcing fillers
 - Fiber compounding
 - Liquid additives

Scale-up

- Scale-up factors based on volume, power, and heat transfer

Thursday, October 8, 2009, 8:30 a.m. - 3:30 p.m.

Compounding experiments on TSK20 extruder

- Introduction to Design of Experiments (DOE)

Industry Best Practices

- Guidelines for set-up, operation and maintenance of your twin-screw equipment

The TSK 20 split-barrel extruder allows participants to visualize what is happening to the materials inside. Hands-on compounding experiments are conducted to reinforce concepts discussed during the classroom sessions.

Bring your current processing problems or screw configuration questions to discuss privately with the instructor...this alone can justify the workshop fee!

Participants will return to the workplace prepared to design and optimize screw configurations as well as develop operating conditions to meet compound specifications.



General Information

Location: The workshop will be held at the Polymers Center of Excellence, University Research Park, 8900 Research Drive, Charlotte, North Carolina. Their phone number is (800) 603-1509.

Hotel Reservations: Attendees are responsible for making their own lodging arrangements. The Marriott SpringHill Suites Charlotte/University Research is conveniently located less than a mile from the workshop location. There is also a Marriott Towne Place Suites at the same location. Check the PCE website (www.polymers-center.org) for more information on local accommodations.

Time: Workshop hours are from 8:30 a.m. to 4:30 p.m. on October 6 and 7. On October 8, workshop hours are from 8:30 a.m. to 3:30 p.m. PCE will provide morning and afternoon refreshment breaks each day, participants are responsible for their own lunch.

Cancellations: If you must cancel, call PCE's Seminar Registrar, Beverly Jarrell at (704) 602-4127. All cancellations are subject to a 10% service charge. **REGISTRANTS WHO FAIL TO ATTEND ARE LIABLE FOR THE ENTIRE FEE UNLESS THEY CONTACT PCE PRIOR TO THE WORKSHOP TO CANCEL.**

PCE reserves the right to cancel a workshop or substitute instructors. If PCE should cancel, they will call that phone number which the attendee has given PCE as the contact, no later than 10 days prior to the workshop. You will receive a full refund if the workshop is cancelled. **PCE is not responsible for airline penalty fees or any other costs incurred by the attendee due to the cancellation of a workshop.**

Registration Information

All registrations must be guaranteed by a purchase order number or a credit card, otherwise the registration will not be processed. Checks should be made payable to **Polymers Center of Excellence** and must include a copy of your registration. **WORKSHOP FEES ARE DUE PRIOR TO ATTENDING.**

Note: all participants are required to sign a “Safe Use Agreement” prior to the hands-on portions of this workshop (see last page of workshop brochure).

All registrations whether by phone, fax or mail will be confirmed by mail and considered binding and subject to all cancellation policies. If you do not receive a confirmation by mail prior to the workshop, please call PCE to verify your registration.

Workshop fee includes classroom and hands-on instruction, seminar manual and refreshment breaks. It does not include hotel accommodations.

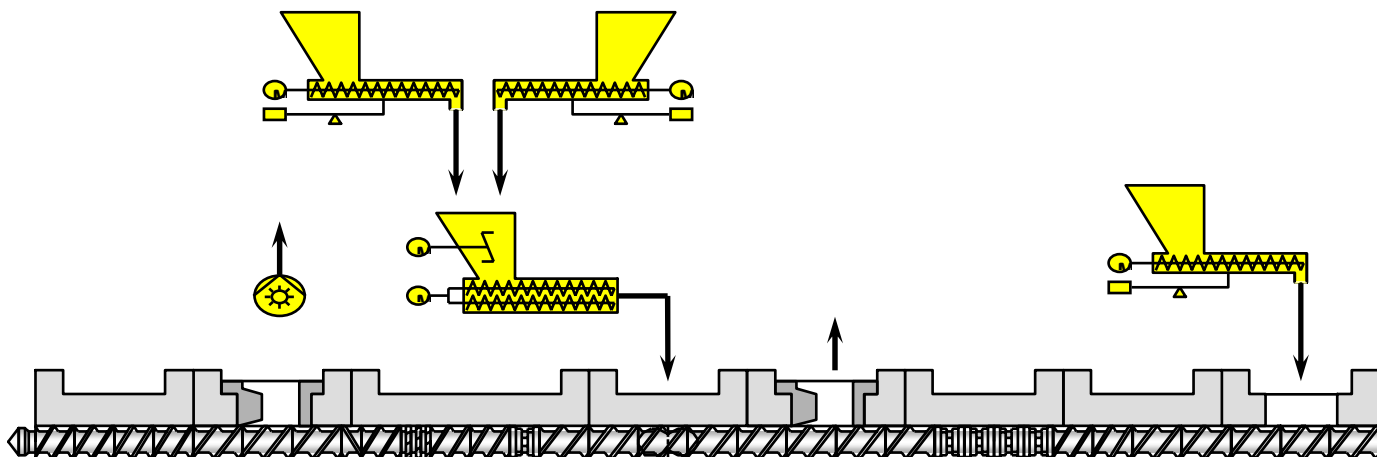
To register by phone: Call PCE's Seminar Registrar, Beverly Jarrell (704) 602-4127, toll free (800) 603-1509.

To register by fax: Send by fax to (704) 602-4114. All registrations must include credit card information, check, or a purchase order number.

To register by mail: Send completed registration form to Polymers Center of Excellence, Attn: Beverly Jarrell, University Research Park, 8900 Research Drive, Charlotte, NC 28262 with a purchase order number, check, or credit card information.

ENROLLMENT IS LIMITED AND ON A FIRST-COME, FIRST-SERVE BASIS

EARLY REGISTRATION IS STRONGLY RECOMMENDED!



REGISTRATION FORM
"MAKING PROPERTIES AND PROFITS"
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Charlotte, North Carolina

All forms of registration must be guaranteed to a credit card or a purchase order number.

To register: call PCE's Seminar Registrar, Beverly Jarrell at (704) 602-4127, toll free (800) 603-1509, or fax the completed registration form to (704) 602-4114, or mail the form below with payment to:

Polymers Center of Excellence, University Research Park,
8900 Research Drive, Charlotte, NC 28262
Attn: Beverly Jarrell

Name _____

Company _____

Title _____

Address _____

City _____ State _____ Zip _____

Phone _____ Fax _____

E-mail _____

WORKSHOP FEES

Early Registration - Before September 1, 2009	\$ 990
Registration - On or after September 1, 2009	\$1100

If you require special accommodations to fully participate, attach a description of needs.

SAVE! Company registrations of three (3) or more save 10% each

PAYMENT INSTRUCTIONS

WORKSHOP FEES ARE DUE PRIOR TO ATTENDING. Please indicate method of guarantee or payment. Make checks (in U.S. dollars) payable to Polymers Center of Excellence and send with registration.

Check Amount \$ _____ Check # _____

P O # _____ Amount \$ _____

VISA MC AMEX To guarantee To charge

Account # _____ Exp. Date _____

Cardholder's name _____ Today's date _____

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Safe Use Agreement and Assumption of Risk to Use Compounding Machinery

It is my understanding that twin-screw compounding machinery can be very dangerous and misuse can result in serious personal injury if all safety practices are not followed. As a result, I will follow all safety instructions presented in the workshop entitled "Making Properties and Profits." I acknowledge that I have been trained in the proper and safe use of this machinery and equipment and that safe practices for machinery and equipment to be used are also listed in the course notes. Furthermore, I will not attempt to operate any machinery or equipment without direct supervision of PCE personnel. If an accident should occur, I will immediately notify instructor(s) or PCE personnel reasonably available.

Name _____ Date _____

Address _____

Affiliation _____

Signature _____