

Post-Conference Event

International Training Program / Workshop (TechnoBiz)

Extrusion Performance Calculations

(for process design, analysis, and optimization)

1-2 April 2010, Impiana KLCC Hotel, Kuala Lumpur, Malaysia

This training workshop is intended for engineers who want to learn how to perform calculations for process design, analysis, and optimization of plastic extrusion. The objective of the program is to teach the participants how to do these calculations by themselves. The participants will work through a number of exercises to develop the skill necessary to perform these calculations independently. Once the basic calculations have been performed, the application of these calculations to design optimization will be discussed in detail. The calculations relate to single screw extruders, twin screw compounding extruders, extrusion dies, heat transfer, mixing, and melt flow properties. Computer simulation will be covered with actual in-class simulations of single- and twin-screw extruders and extrusion dies.

Program Outline

1. Introduction

- Data collection
- Throughput and specific throughput
- Pressure consumption and variation
- Power consumption and variation
- Energy consumption and specific energy consumption

2. Single Screw Extruders

- Solids conveying rate
 - optimum channel depth for solids conveying
 - optimum helix angle for solids conveying
- Melting rate
 - optimum helix angle for melting
 - effect of number of flights on melting
- Melt pumping rate
 - optimum channel depth for melt conveying
 - optimum helix angle for melt conveying
- Volume occupied by the plastic in the extruder
- How much plastic is needed to purge the extruder
- Torsional stresses acting on the screw
- Computer simulation

3. Twin Screw Compounding Extruders

- Melt conveying rate conveying elements
- Melt conveying rate kneading elements
- Calculating stresses generated in kneading section
- How to assemble screw elements into a complete screw design
- Special screw elements
- Computer simulation

4. Die Design Calculations

- Velocity profiles in simple shapes
- Flow rate and pressure drop calculations
- Shear rate profiles in simple shapes
- How to predict the onset of melt fracture
- How to predict problems with stagnation
- How to achieve balanced flow predictably

5. Heat transfer calculations

- Temperature profiles in drag flow
- Temperature profile in pressure flow
- Viscous heat generation
- Melt temperature increase from viscous heat generation
- Residence time and residence time distribution
- How to determine whether the plastic will degrade
- Cooling of the extruded product
 - Air cooling
 - Water cooling

6. Mixing

Distributive mixing

- Striation thickness and interfacial area
- Effect of viscosity ratio
- How much shearing is necessary to achieve good mix quality

Dispersive mixing

- Critical stress for breakup in agglomerates
- Critical stress for breakup of droplets
- How to calculate shear stress
- How to calculate elongational stress

7. Melt Flow Properties

- Melt flow index (MFI)
- How viscosity relates to MFI
- Capillary rheometer
 - How to determine the melt fracture window
 - How to determine the power law parameters
- How to obtain viscosity data directly from the extruder

Who should attend this course?

- process engineers and manufacturing engineers involved in extrusion or compounding operations
- engineers responsible for the design of extrusion equipment (OEMs) or components (screw manufacturers, die manufacturers)
- technical service personnel from resin producers and extruder manufacturers that need to solve extrusion problems and perform process optimization
- R&D scientist that want to learn how to use extrusion theory to solve real extrusion problems and optimize extrusion processes

Prerequisites:

- Basic knowledge on extrusion
- Basic extrusion theory
- Bachelors degree in engineering or physics

Program Instructor – Dr. Chris Rauwendaal

Dr. Chris Rauwendaal - President of Rauwendaal Extrusion Engineering, Inc. since 1990; previously with American Enka Company and Raychem Corporation. *Chris* received a M.Sc. from Delft University and a Doctorate in Polymer Processing from Twente University in the Netherlands. *Chris* is a well-known author, lecturer, entrepreneur, and consultant in the field of extrusion. He holds numerous patents and has written more than 200 articles and seven books related to extrusion, mixing, injection molding, and statistical process control. *Chris* has developed video training courses and interactive training programs on extrusion, injection molding, and SPC. He has been involved in technical meetings of the SPE and PPS for many years as a speaker as well as a technical program chairman. *Chris* is a Fellow of the Society of Plastics Engineers. *Chris* is the developer of the CRD and VIP mixing technology that utilizes strong elongational flow to improve mixing in extrusion and molding. CRD mixing devices are successfully used in many extrusion operations. VIP mixers were recently introduced to the plastics processing industry and are gaining rapid acceptance. Work is ongoing to extend this technology to a new generation of extruders and injection molding machines. The most recent development is the HHT (high heat transfer) extruder screw developed to improve cooling in foam tandem extrusion operations.

Registration Fee

- 650 US\$ / Person (before 31 January 2010)
- 750 US\$ / Person (after 31 January 2010)

Registration fee includes training documentation, lunch and refreshments

Program Agenda: 09.00 – 17.00
Language: ENGLISH

For more information, Please contact

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