Ask the Extruder

Ask the Extruder
Vol. 33 #1, Summer 2006

Trying to understand, analyze, and subsequently model the extrusion process is often done with basic laws of physics and "traditional" constitutive laws and constants (e.g., solids conveying models using sliding friction factors measured for flat plates.) However, another approach has been utilized for years with great success. The approach, metaphorically and simply put, is to "ask the extruder" how it works, what are the important constitutive constants, and what are their values? The approach requires knowing what "questions" (measurements) to ask of the extruder and then how to interpret the "answers" (data and calculations.)

Historically, the early screw pulling work of Maddock is classic in directly "asking the extruder" as to what goes on during the process. Maddock "asked the extruder" by suddenly stopping it, freezing it, and then pulling the screw. Observations of the frozen polymer on the pulled screw then provided data so that calculations about the nature of the process could be correlated. Later work by Street and Tadmor and Klein followed a similar approach.

With the advent of the computer in recent decades, more elaborate computational means have been possible for "asking the extruder" about the process. Derezinski showed that solids conveying friction factors, a solids conveying model, a melting model, as well as barrel heat transfer coefficients for a melt temperature model can all have be determined from machine data by computational means. Most recently, a perturbation technique by done by Shih and Wetzel for studying the melting rate has been shown. Their innovative work uses machine data taken during the "pulse" of the flow with a different polymer. A computer model analysis is then used to determine the nature of the melting process from those data.

Pure researchers tend to discount the effort of "ask the extruder" methods. However, the method has led to greater understanding of the process from the most practical point of view with a high degree of confidence in the answers. For those in an industrial setting, confidence and accuracy in the predict- ed performance of the machine is a top priority as opposed to being scientifically and mathematically rigorous. Getting "answers" directly from the machine in question about how it operates has been repeatedly shown to provide for a high degree of success in making any changes or improvements.

In summary, and simply put, "No one has been known to shut down an extruder that was running well because the design was not obtained through the most scientifically and mathematically rigorous means."

– Stephen J. Derezinski, Ph.D. Extruder Tech, Inc.

Return to Consultants Corner